KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. III. OCTOBER, 1879. NO. 6.

GEOLOGY AND PALÆONTOLOGY.

BOTANY AND EVOLUTION.

BY PROF. B. F. MUDGE, MANHATTAN, KANSAS.

PLANTS CONTINUED—DICOTYLEDONS—RECENT.

(*Continued.*)

The great era in plant life, and the most important and radical change in vegetable structure during our whole geological history, was the introduction of the Dicotyledonous form. It includes all the common cultivated and forest trees and shrubs of the Temperate Zone—except Conifers—having a net-veined leaf and annual ring of growth, with two cotyledons in the embryo. It embraces the first fruit-bearing plants* which could furnish food for man or most of the herb ivorous mammalia. At the beginning of the Cretaceous Age the Dicotyledons appear in numerous forms, without any predecessors connecting them with the vegetation of the preceding ages. The Pine, their nearest allied type, had been in existence during nearly one-half of the period of the organic history of the globe, or, not less than twenty millions of years, and left no tree more nearly connected than the first trunk of the Silurian. At their first entrance on plant history, the Pines had representatives of the important types of our own day, but not one diverged toward the Dicotyledons.

*Palms furnish food, but they were not common until after the existence of the Dicotyledons.

The Dakota, or lowest group of the American Cretaceous, affords, according to the careful labors of Prof. Leo Lesquereux,* not less than one hundred and sixty-four species of fifty-two genera, and nineteen orders of Dicotyledonous plants; and new species are constantly being added to them. All these are found over an area but slightly examined, having a vertical thickness of not over five hundred feet, while the total thickness of the strata containing fossils has been estimated at from eighty to one hundred thousand feet. Prof. Lesquereux is very explicit in expressing his opinion of the newness of the flora and of its resemblance to our present vegetation. He says: † "But the Cretaceous flora does not preserve any traces of ancient forms known of old. * * * They represent Phænogamous [bearing true flowers, embracing all the highest forms of vegetation] plants, distributable not in a single one, but in all the essential groups of vegetables living at our time. * * * All these types are, therefore, present in the North American flora, some of them with scarcely any alteration of forms." They include the Oak, Willow, Poplar, Beech, Laurel, Sassafras, Magnolia, Maple, Birch, Hickory, Cinnamon, Fig, Plum, and Apple (*Pyrus*), besides many small and inconspicuous shrubs. The different genera are as equally well marked and distinct as those of the present day.

We would call particular attention to the fact that the flowering plants of the highest genera and most perfect type appeared among the first Dicotyledons, as a contrary statement has been frequently made by writers favoring evolution. If any one will consult the writings of Lesquereux, Heer, Saporta or Schimper, or, what is more proper, the rocks of the lowest Cretaceous, he will find a full proportion of the highest rank (*Polypetalus*) at the first dawn of the Dicotyledons. Among them he will have the splendid Magnolia and Tulip-tree, and our fruit-bearing *Prunus* and *Pyrus*, or Plum, Pear and Apple. The highest and lowest Dicotyledons appear suddenly, together with the Apetalous, Monopetalous and Polypetalous, and in about the same proportions as they now exist. They all appear without predecessors, though in Colorado the underlying strata are conformable, without any interval in the continuity of the deposits. The distinguished palæontologist, Prof. Lesquereux, uses the following clear language on this point: "And the conclusion, evidently forced, at least in considering the flora of the Dakota group, is that its disconnection from ancient types is so wide that even the supposition of intermediate unknown vegetable types fails to account for the origination of its peculiar characters. * * * No trace of a leaf referable to a Dicotyledonous species has been recognized anywhere before the Cretaceous." (Flora, pp. 35 and 36.)

This feature of resemblance to living vegetation is increased by the examination of specific forms. At first Lesquereux was disposed—like all palæontologists who find familiar forms in an unexpected geological age—to decide that all the species were extinct, and he so assigned their names. But in his later writings,

* See Cretaceous Flora and other publications of that distinguished Palæontologist.
† Cretaceous Flora, pp. 37 and 40.

after exchanging opinions with the best fossil botanists of Europe, he has been led to change his decision, at least concerning one species. Prof. Lesquereux names one of the Sassafras leaves, found in the Dakota of Kansas, *S. Mudgei.* But in a more recent discussion of the resemblance of the fossils of this whole group to the living forms, he says: "Comparing leaves of *Sassafras officinale* [the living plant of the United States] with those represented by Count Saporta in the Flora of Sezane, and the specimens of *S. Mudgei* from Kansas, it is impossible for me to recognize any character, even any specific difference, by which these leaves could be separated." * And Prof. Schimper, referring to *Sassafras cretaceum*, another Kansas specimen, says: "Those leaves, very variable in size, present such a remarkable likeness to *S. officinale*, now living in North America, that one would be disposed to consider them as belonging to an homologous species." †

It is a peculiar fact that, while we have but one living species of Sassafras in the United States, we have at least six from the limited area covered by the Dakota in Kansas. The genus began with numerous species and ended in one.

Sassafras primigenium, from the Cretaceous of Greenland, appears to be in the same category. Thus we have the highest authority for stating that not only more than half of the genera, but even some species of the oldest Dicotyledonous trees, are now growing in the Temperate Zone. Further examination by our eminent floral palæontologists will undoubtedly add other species as living representatives of this old, early vegetation. The Fig (*Ficus*), of which Lesquereux describes several species, shows a close resemblance to several now growing in Cuba and Florida.

Taking Prof. Lesquereux's list of the Dicotyledons of Dakota, we find fifty-six per cent of his genera are identical with those now living in the Temperate Zone of the United States east of the Rocky Mountains. To this must be added twenty-four per cent which are apparently identical, represented by Populites, Betulites, Acerites, Negundoides and others. Of the remaining twenty per cent, a few like the Fig and Cinnamon are now tropical, while some are of extinct genera, "not referable to any of the types of our present vegetation."

The great and sudden change in the vegetation at the opening of the Cretaceous Age has been noted by European evolutionists, and explained by the fact that in that quarter of the globe a marked break occurred between the Jurassic and Cretaceous. It was claimed that if the connected history of the two formations could be found, it would give the missing links between the old and new vegetation. But the labors of the geologists in the Rocky Mountain region have found these formations pass into each other, without any chasm or break in the continuity of the strata, all being conformable; yet we have the same sudden and abrupt change in the type of the vegetable life that has been seen in Europe, pressing so hard on the evolution theory. Along the "foot-hills" of Colorado, from Morrison to Cañon City, a distance of over a hundred miles, the

* Geological Survey of the Territories, Hayden, for 1874. p. 328.
† Traite de Paleontologie Vegetale, vol. iii, p. 598

writer has found Dicotyledonous leaves abundantly in the Dakota on the tops of the hills, and two hundred feet below were the unmistakable fossils of the Jurassic. In the thousands of feet of the homogeneous, conformable strata below, not a trace of a Dicotyledonous plant could be found. The missing links in vegetation are just as decidedly absent as before the connection of the two formations were discovered.

It is also an admitted fact that the first Dicotyledonous trees were none of them of a lower type than those now flourishing. Man might have lived on the fruit of the Fig, Palm and Pyrus, by cultivation, then as well as to-day. The resemblance of the flora of the Dakota to the modern is also seen in the Redwood (*Sequoia*)—the genus to which the wonderful big trees of California belong—which is also found in this geological group.

When, therefore, there is so large a generic, and even some specific identity, between our common fruit and forest trees and those which lived not less than six millions of years ago, we are justified in concluding that there is little if any development or evolution in this branch of organic nature, and the variation, considering the enormous lapse of time, is confined to a very small circle.

Quite recently Dr. Oswald Heer, in reporting upon the fossil plants brought from Greenland and Spitzbergen, by the two Swedish expeditions of 1870 and 1872, in the summary of the results, states clearly that the facts are against a gradual transformation of plant types. His facts in relation to the resemblance of the Cretaceous and living vegetation agree very nearly with those of Prof. Lesquereux. In the Upper Chalk of those countries, as in our Dakota, the Dicotyledons appear suddenly in great varieties, representing closely our living genera.

Among all our fossil plants, there is no order not found living although, on the authority of Hooker, two hundred orders are known. In other words, if we admit evolution, there has not been sufficient change in plant life, marine or terrestrial, in all earth's history of not less than fifty millions of years, to advance a single order beyond its original characters. Nor, on the other hand, has earth's change been able to destroy an ordinal type.

If we study carefully the history of living vegetation, we shall find that the great stability and persistence of form which we have noticed in the fossil Pines, Cycads, Palms and Dicotyledons remain to-day. Though we find no two flowers, no two apples or other fruits just alike, yet all these variations are restricted to a narrow limit in each species. The marked variation which we notice in a single season is scarcely changed in ten, and not increased further in a hundred. Though man's agency—powerful, if you choose to call it so—may increase the variety, it never goes beyond the specific bounds. The barley found charred in the ruins of the Swiss Lake dwellings, believed to be many thousands of years old, is identical with that cultivated in modern Europe. While we need not credit the story that wheat embalmed with mummies has germinated, it is admitted that such wheat has been found. Such grains, together with the pictures in the old tombs and early descriptions by historians, induce us to conclude that

Egyptian wheat was not materially different from that now cultivated in North America. So the fruits and seeds from Pompeii have been identified with those now growing in southern Europe.

The history of living vegetation runs in harmony with the fossil. European civilization and emigration have carried the plants of that quarter of the globe to almost every other clime. Many, both useful and noxious, have lived and flourished under most diverse circumstances. Whenever they have been planted in soil or with climate too uncongenial for their habits, they have died, but never changed to new species. Many of our troublesome weeds have been introduced from Europe and have spread over nearly all parts of the United States, from the moist climate of the sea coast to the dry plains of Colorado; but never has a new species, much more a new genus, been developed Two hundred and fifty of old England's weeds are found in the fields of New England without change of features. Many have gone to Australia with the same result. The efforts to acclimate foreign plants in Europe have shown the same result. For hundreds of years there have been hot houses and botanical gardens all over Europe, subjecting the vegetation of all climes to new surroundings, but no plant has assumed a sufficiently new form to induce botanists to recognize it as a new species. Some of hardy temperament have changed sufficiently to be called new varieties. The artificial atmosphere of hot-houses has usually dwarfed tropical shrubs, without causing them to change in other respects. Oranges, bananas and pine-apples have still remained such. Palms have lost their vigorous growth, but have never become degraded to a lower form. If, in all the artificial life surroundings which man with his high intellect is able to give to plants, we have so little change, will unassisted nature do more?

The common domesticated farm and garden vegetation furnishes numerous illustrations of the persistent law which controls plant life. Our winter and spring wheats are varieties of one common stock—*Triticum vulgare*. This species includes nearly all the cultivated wheat, which numbers over three hundred varieties. Notwithstanding *Triticum vulgare* assumes so many phases, which are constantly increasing, it shows no tendency to intermingle with the other species of *Triticum*, though human agency is far more powerful in creating varieties than unaided nature. Wheat never changes to chess, nor chess to wheat. Nor has all human agency been able to change the features of any other species of *Triticum* so as to furnish a good bread wheat. The varieties of Barley are from three species of *Hordeum* (*distichum*, *hexastichum* and *vulgare*), but no food grain can be procured by the cultivation of the other species of *Hordeum*. These species, cultivated with all our care, never intermingle. No hybrid can be found. Rye is from *Secale cereale*, nearly allied to wheat in botanical character, and has been cultivated with the other cereals from the earliest times, under the same circumstances, by the same human agencies, but neither grain has shown any tendencies to assimilate with the other or to assume a common form. If like circumstances produce like results in the botanical world, these grains should long ago have become one, or at least assumed new specific traits.

Wheat, Barley and Rye illustrate another characteristic of plant life. The first is very flexible and protean in forms and varieties, while the others are the reverse. Yet each is exceedingly persistent in retaining not only its generic, but its specific features. Each is true to its own circle of vitality. All have been cultivated during unknown ages, from the dry, hot valley of the Nile to the cold, damp regions of northern Europe, on the Alps and in sunny Italy, yet man has never been able to develop a new species. So with all our common esculent roots. We can produce new varieties of potatoes, beets, water-melons, musk-melons and the other garden products, but we have not, with all our skill, been able to make a new species.

In our cultivated fruits we find more diversity, but without passing the line of species. Downing reports about 3,650 varieties of Apples raised in America. Yet all are Apples. They have common traits and habits, with no tendency, in all our varied culture, from Canada to the Gulf and from Maine to California, to become anything but Apples. There is no disposition in these three thousand six hundred and fifty varieties, though they are constantly sporting, to commingle with the nine hundred varieties of Pears cultivated in the same orchards. This is the more worthy of notice as the Apple and Pear belong to very closely related species of the same genus—*Pyrus*. Both are exceedingly flexible, but each is restricted to its specific form.

In this connection, grafting, an abnormal product of the art of man, is worthy of notice. The Pear is frequently grafted on the Quince root (*Cydonia vulgaris*), a plant different in generic as well as specific structure; yet the stem, bark, leaf and fruit not only adhere to the true Pear form, but even the variety of Pear is preserved. If it be a Bartlett, it still retains the shape, color, flavor and every other trait of that well known fruit. The root is still Quince, but all above the point of grafting is still a Pear.

If the cultivated plants vary so little under the fostering hand of man, we cannot expect to find any greater change in wild, unaided nature. Hardy plants may have a very extensive range under diverse surroundings, but, instead of rising or sinking to new species, we find them holding their peculiar specific features as long as the seeds will germinate. Instead of changing, death ensues. All our common plants, to a greater or less degree, show this ability to endure a great extreme of soil and climate, the influence of circumstances being shown in a greater or less vigor of size and foliage. To make a list of such plants would require pages of this work.

Take the common Dandelion (*Taraxacum densleonis*). It is indigenous to Europe and America, and abounds from Kentucky northward, and from the moist shores of the Atlantic to the dry plains of western Kansas. The Polaris found it also in the most northern spot visited by man—in latitude 82°, or within eight degrees of the Pole. Its green and gold are just as strongly in contrast, and its seed furnished with a pappus just as lightly constructed, under all this diversity of circumstanes. The Gentian (*Gentiana*) is also a good illustration of the same

persistency under extremes. It flourishes along our ocean shores from Maine to Georgia, on the Rocky Mountains over ten thousand feet above the level of the sea, on the European mountains to the snow line, and on the borders of the desert of Sahara. In all situations it retains the same normal appearance in root, stem and branch, and does not even lose the soft, deep blue of its corolla.

It will thus be seen that Botany, so far from being that branch of natural history to favor or prove evolution, is in its record a constant revelation of a steady and strong adherence to normal types. No era of earth's history shows that vegetable forms, whether high or low, from their first introduction, have varied from their early characteristics.

The Fucoids, and other marine genera of the early Silurian, are represented by similar forms in the present seas. They still present the same soft, mucilaginous mass, without seed vessels, and with the most simple organizations. The fresh-water plants of the Carboniferous are very similar to those of our present swamps. The ferns and club mosses of our ravines and forests have no marked improvement in organization over those of the Devonian and Coal measures. The Pines, Cycads and Palms have varied so little from their first garb that if they were resurrected and placed in groves of their living representatives, they would give no new feature to the forest scenery. Even these changes, small as they are, have not been shown to be the result of evolution.

We admit that if evolutionists could show that, while the great mass of vegetation has been persistent and unchangeable, there were some, even a few, genera which have varied and developed into other genera, then the persistence of the mass would be no evidence against evolution. But no single instance has yet been shown, from fossil or living plant, that one genus has ever passed into a new generic form. With such an abundant evidence on one side, and none on the other, what must be the conclusion?

If plant growth is subject to such strong variation from a change of surrounding circumstances as evolutionists assume, why is it that, in almost every genera of vegetation, we find so many different species growing in the same valleys and meadows? From the oak to the orchis, and from the willow to the Violet, we find numerous species of the same genus living together. If species are the outgrowth of circumstances, why do the combinations of heat and cold, moisture and the want of it, darkness and light, produce so many species of the same genus in the same valley; or, when produced, why do they retain so persistently the same differences for long periods of time? Why, in the Dakota epoch, when the Dicotyledons first came into existence, were there growing on the same islands so many species of Oak, Willow, Magnolia and Plane-tree,* flourishing side by side with trees so antagonistic in structure and habit as the Fig, Palm, Cinnamon and Pine? All these, too, retain their generic and some their specific representatives to this day. Why do species each retain, even in the same meadow, the same color and odor peculiar to itself? The odor and color of flowers,

* Lesquereux has already described ten species of Quercus, six of Salix, five of Magnolia and six of Plantanus, and the explorations are only commenced.

though ever so striking, are such infinitely small component parts of a plant that the most subtle chemistry has seldom, if ever, been able to detect the substances which cause them. If like physical causes produce the same results in the organic world—and this is the cardinal principle of evolution—then plants of the same ~~germs~~, growing in the same sunshine and same soil, should gather or elaborate that substance which yields the same fragrance and the same hue. The "environment" is the same for all.

The incongruity of plants entirely dissimilar in structure and fruit, living under the same circumstances, has not escaped the observation of writers in our current literature. Hawthorne, in his Stories from an Old Manse, speaking of the beautiful water-lily (*Nymphæa adorata*), says: "Why is it that this perfect flower derives its loveliness and its perfume from the mud out of which others draw such obscene life and noisome odor?"

FOLLOWING THE PICK AND THE SPADE.

BY JUDGE E. P. WEST, KANSAS CITY.

Amid the bustling scenes of the ever pressing activities and needs of life spanning man's brief abode among the picturesque hills and valleys environing the confluence of the greatest of North American rivers with one of its principal and most attractive tributaries, we seldom pause to think of the evidences of geological and topographical changes which lie buried at our very feet.

But those who will take the pains to observe closely what is revealed by the pick and the spade in the ordinary pursuits of this busy age, at Kansas City, will find many things of interest to attract their attention pertaining to changes and events long since past. Evidence will be found of the working of silent forces which effected stupendous changes millions of years before the voice of man was heard or his energy impressed upon the earth's solid crust. The imagination must be permitted to run back to the close of the Upper-measure formation, and its subsequent elevation to near its present level, and follow the changes which have since taken place. At this time, where West Kansas City now stands in a deep valley, there was a continuous line of the high bluff bounding the Missouri River filling the gap now cutting across the the Kansas River valley from Bluff Street, in Kansas City to the high point of undisturbed stratified rocks near the center of the city of Wyandotte, Kansas. The channel of the Kansas River, through which its waters then flowed, was along the McGee Creek valley, and Goose-neck Creek valley, and its confluence with the Missouri at or near the present mouth of the Big Blue River, in Jackson county, Missouri.

Since the close of this era all the ravines and channels about Kansas City and Wyandotte, whether now exposed to view or remaining buried beneath the Loess deposits, have been cut through the solid stratified rocks to their present

depth. Two well marked geological epochs which have transpired since the close of the Carboniferous era will afford some clue to the order of their occurrence; we allude to the Drift era which marked the first great change, and the Loess epoch, which was subsequent. The Drift is well marked by erratic deposits of transported sand, gravel, and boulders, and the Loess is equally well defined by the brick clays, from which our superior quality of bricks are manufactured in Kansas City. The channel of the Missouri River was cut to a depth greater, perhaps by two hundred feet, than now marks the bottom of the river, the area of country lying north of Seventh Street and between it and the river, extending from the junction of Sixth Street and Bluff Street, in Kansas City along the general line of Seventh Street east, bending in from Forest Avenue by Dikington Park to the river valley, was denuded by the attrition of the Missouri River down to the Bethany Falls limestone, and most or all the ravines pointing in to the two rivers, as they then ran, were worn away before the Drift epoch was ushered in. This is proved by the drift which fills the old channel of the Missouri River to a depth, perhaps, of two hundred feet below the present bed of the river, and which rests, buried under the Loess, on the Bethany Falls limestone in the denuded area before defined, and which is to be found, covered under the Loess, in the old ravines pointing northward to the Missouri River. But a significant fact, which will be alluded to hereafter, must not be overlooked, namely that the Drift deposit is not found in this vicinity south of the Bluffs marking the south bank of the Missouri River. The high, narrow promontory which formerly divided the Missouri River from the Kansas River between their present confluence at Wyandotte and their former confluence, at the mouth of the Big Blue River, has been cut through in two places. One between Kansas City and Wyandotte, where the Kansas River now empties into the Missouri, embracing the present Kansas River valley, at its mouth, and the other not so wide but well defined, extending from McGee Creek valley, in the southern portion of this city, to the Missouri River, along and embracing Grand Avenue, a part of Walnut, Main, Delaware and Walnut Streets. These channels or gaps through the previously continuous bluffs, were made, no doubt by the action of the currents of both rivers cutting away from the opposite sides of the narrow promontory dividing them, by exceeding slow advances, during the almost immeasurable time intervening between the close of the Carboniferous age and the beginning of the Loess time. This view is sustained by numerous considerations. In the first place, there is no other apparent cause which could have accomplished the stupendous work of removing so formidable a barrier, while the cause assigned would be fully and naturally adequate to the task. And, besides, this is rendered more probable by the conformation of the bluffs, both along the Missouri River and the Kansas River. The bluffs on the Kansas River toward its mouth bend to the northeast, while those along the Missouri river, above and in the same vicinity, curve to the southeast. In the next place, these channels could not have existed during the activities of the Drift era, or the erratic Drift deposits would be found south of them lodged against the Kansas River and McGee Creek valley bluffs, as

they are found east lodged against the Missouri River bluffs, on the south side and west of them, lodged against the Kansas River bluffs on the south side. The deposit west of the mouth of the Kansas River extends some miles further south than those east along the Missouri River bluff, and along the bluffs south of the gaps there is none to be found at all. So these gaps, one of which now forms an outlet for the Kansas River, must have been chiseled through the solid bluff by the action of the water, after, or about the close of the Drift epoch. The work was aided, perhaps, by an increased volume of water in consequence of the melting away of the glaciers, which had previously existed, about the close of the Drift period. Numerous erratic blocks of the Drift are found in Wyandotte county, Kansas, as far south as the south bank of the Kansas River, and they can be found in Jackson county, Missouri, as far south as the bluffs on the south side of the Missouri River, but not south of those lines.

The remains of extinct mammals have been taken from the Drift, at Kansas City, and the evidence of man's presence has been found embedded in the Loess, under circumstances to render it certain of his presence in this vicinity, while the Loess deposit was yet going on. The old slopes of the bluffs and ravines as they were before the Loess deposit buried them under its thick mantle, are revealed sometimes by the attrition of water, and sometimes by man's industry. Two examples of the latter may be named. In grading the block on the northeast corner of Seventh and Walnut Streets, after removing about fifty feet of Loess, the old slope of the bluff was encountered and uncovered on the south side of the block. Seventh Street, at this point. was graded along the north slope of the bluff bounding the river on the south, as it was before the Loess deposit covered it in and filled up the denuded area before alluded to, over the Bethany Falls limestone in this district. The other example is to be found at the intersection of Ninth and Main Streets. In excavating the lot at the northeast corner for the basement of a building to be erected thereon, after removing five or six feet of soil and Loess, the slope of the bluff bounding the east side of the old channel extending from McGee creek to the Missouri river was encountered, and the debris removed from the east end of the lot; but excavation terminates at the west end, in the tumbled down rubbish still resting on the surface of the old slope. The owner of the property would do well to look closely to this matter before putting in the foundation of the house to be erected, and save perhaps by doing so thousands of dollars which may be wasted in pulling down cracked and broken walls, after the building is erected.

The cut on the Hannibal & St. Joseph Railroad west of the bridge, and the cut on the St. Louis, Kansas City & Chicago Railroad west of Main, and at Grand Avenue, disclose the Drift resting on the Bethany Falls limestone, buried under more than a hundred feet of Loess.

Numerous matters connected with long past events of great interest to those who are fond of studying past changes, revealed by the pick and spade, might be considered, but our space will not permit of it at present.

—*Mirror of Progress.*

THE STONE AGE IN KANSAS.

BY W. H. R. LYKINS.

The town of Lawrence, Kansas, is situated upon an irregular bench or terrace extending for some distance along the south side of the Kansas river. In the western part of the city where I have more particularly examined this terrace formation it is constructed as follows:

1. Soil two feet. 2. Gray and brown clays interspersed with small stones twenty-five to thirty feet. This bed has evidently been formed in the course of time by washings from the adjacent hills. 3. Coarse river sand and gravel three to five feet. When this bed is reached permanent wells of fine water are obtained. This was doubtless an old bed of the Kansas river when it ran at a much higher level than at present, as the material of which it is composed is identi al with that found on the sand bars of the Kansas. 4. Blue shale twenty feet. The whole rests upon the Carboniferous limestone which crops out at the water's edge. These measurements are from memory, my original notes having been lost, but are near enough for the present purpose.

Passing one day along Louisiana street near where a well was being dug, I stopped to examine the work. The diggers had just penetrated No. 3, or the old river bed, several tubfuls of which had been thrown out. While working over the heap looking for curiosities, I came upon a veritable worked flint. There could be no mistake about the locality from whence it came, as it was still wet and stained the same red ocherous hue as the associated stones and pebbles. This implement was of an irregular oval or leaf shaped pattern, about four and one half inches long and two and one fourth inches wide. One side to the point had been dressed to a cutting edge, the other side had been left nearly in its natural state, and it seemed to have been used for scraping or skinning. While the workmanship was rude, its artificial character could not be mistaken by any one accustomed to handling worked flints; the regularity and peculiar conchoidal fracture of the chippings showing plainly that it was the work of human hands. The material of which it was made was the common blue flinty stone found in the surrounding hills. Recognizing at once the importance of my discovery, I made an accurate section of this part of the terrace which, with explanatory notes and the implement itself, I designed sending to the Smithsonian Institution, but the whole was unfortunately lost a short time afterward, on that memorable 21st of August when Lawrence went down in fire and blood at the hands of Quantrill and his guerrillas. Now while I do not expect my discovery to take its place as an authenticated find, the evidence of its authenticity being lost, I desire to place the fact upon record in order that other observers who may have the opportunity may be on the look out for such relics in similar situations. In 1852 I saw a tooth and some bones of the mastodon taken from this same old river bed in a well being dug near Silver Lake some miles above Topeka.

I have in my possession at present an interesting relic found on the Shunga-

nunga, near the great mound south-west of Topeka. It was found about three feet below the surface by some parties who were digging down the bank of the creek to make a wagon road. It is a symmetrical keystone four inches in length by two and one inches in width at the ends, made of a pale blue stone not found in that part of Kansas. The upper end has a small round hole in it much worn as if by a string by which it was probably hung around the neck of its owner. It appears to have had some hieroglyphics or figures on it, but it had been used by the person who found it as a whetstone, which has nearly obliterated the markings. Many fragments of old Indian pottery were found at the same place.

Some of the Indian tribes used flint implements down to a very late day. About 1840 a party of Kaw Indians came to our farm near Westport, Missouri, on a trading and begging expedition. Some one on the place traded a pig for a dressed buffalo robe. The Indian killed it with an arrow and turned it over to his squaw who took from her belt a piece of white flint about five inches long and two inches wide, square at the ends but very sharp on the sides, with which she skinned the pig as quickly and neatly as a butcher could have done it with his knife. The Indian boys at that time still made and used flint arrow heads, and the medicine men prepared a sharp splinter of flint for bleeding and cutting.

POLITICAL SCIENCE.

BRITISH IMPERIALISM AND THE AUTONOMOUS RIGHTS OF RACES.

BY A. H. THOMPSON, TOPEKA, KANSAS.

(Concluded.)

The objection that may be made as to the insecurity of foreign life and property and the consequent check put upon commerce and enterprise under native rule, may be met by the consideration of the fact of the presence of the army of occupation of the foreign civilizing nation. It will, of course, be part of the duty of this army to protect foreigners, their life and property, and at the same time to protect the natives from injury and injustice by foreigners. The advantages of and safety to trade would be just as great, perhaps greater, under a civilizing protectorate as under the system of political conquest and government. There would not be the ever present desire to resent oppression and effort to throw off the yoke of the conqueror. Mutual faith and interest would, in time, inevitably promote mutual safety. The temptation to oppress, which is the natural accompaniment of power, would be absent, and mutual rights would be recognized and respected. The facilitation of barter and trade, the foreign ownership of property, mutual advan-

tages to both races by inter-commerce, and the development of native industry, would, we cannot but believe, be promoted with safety and success.

It may be objected, also, that the unrestrained practice of the racial autonomy system would lead to the formation of innumerable petty nations, some of them embracing a very limited territory and few people. We admit that this would be the inevitable and natural result. Yet, with most races, the extensive and comprehensive bonds of ethnic affinity and relationship, racial pride and patriotism, and uniformity or similarity of physical and mental characteristics, customs, etc., would lead naturally to the coalescence of related tribes. The size of a nation would then be governed by the numbers of each of the greatest divisions of races and sub-races, and petty schisms would be unlikely to occur, with the spread of intelligence, especially as division beyond a certain line would be discouraged by the united sentiment of nations. The system would, to a certain extent, be a return to the primitive petty subdivisions, but it would be none the less perfect and conducive to the greater happiness of the world, for all that. Every individual would be the happier to know that himself and his nation were "free," were their own rulers instead of the slaves of a foreign conqueror. This liberty would be enjoyed from the lowest man in the land up to the racial head and ruler, and patriotism would be a national enthusiasm. Independence contributes more than any other one thing to the happiness of a people, and foreign rule most of all to their misery. General and prevailing happiness would, we hold, more than compensate for any disadvantage arising from the subdivision of the species into petty nations, or for the failing to develop great and ambitious powers.

History teaches us in all ages that the overgrown nation must and will surely fall to pieces, and principally on account of the ethnical heterogeneity of the elements composing it. In the classic ages one great empire succeeded another, arising upon the ruins of predecessors, and to be in turn overthrown and succeeded by others. These powers were upheld by force and cruelty alone, and their downfall was usually sudden, swift and terrible. Forcible confederation of heterogeneous races was a treacherous and loose union, and danger lurked in the naturally rebellious bosom of every man. There could be no patriotism for a foreign government ruling by force and cruelty, and where patriotism was absent danger was ever present to the state. Heterogeneity soon found expression in misunderstandings and conflicts. Powerful rebellions arose, and the great power was no more. One tyranny was, however, merely exchanged for another, which in its turn conquered and annexed friend and foe alike, to be in its turn overthrown and supplanted by another. We learn from the examples of antiquity, and of later times, that the nation which adopts a policy of unlimited conquest, either for the purposes of mere national ambition to rule, aggrandizement of territory or for revenue, without regard to the ethnical relationship of the people conquered to herself, ventures upon a dangerous sea and where many a ship of state has foundered utterly.

No nation, no matter how powerful, can expect to cement many peoples of

antagonistic ethnical qualities into one harmonious whole. England is beginning to realize this truth in her experience with India. The Saxon and the Hindoo cannot affiliate any more than oil and water can be made to mix. Russia has been successful in maintaining the unity of her peoples under a most clumsy system, for the reason—by wisdom or accident—that her Asiatic, as well as European subjects, are really all of a general if not special relationship to the dominant tribe. There is perfect understanding of ethnical peculiarities and appreciation of mutual tastes and prejudices between ruler and people, which goes further than anything else in securing unity—further even than her despotism, to which her people are accustomed.

The nation that oversteps the bounds of ethnical right, as defined by nature, enters upon a system of murder and robbery that will inevitably bring about the just retribution of its own utter ruin. If the great nations of antiquity had been composed of related peoples alone, their national life would undoubtedly have been longer. Their fall has usually been attributed to the weakness brought upon their rulers by luxury and dissipation consequent upon the possession of ill-gotten, boundless wealth. This, in some cases, may have precipitated ruin and made the opportunity which the real cause—the ever present discontent of heterogeneous, subjugated peoples—was not slow to improve.

England has been committing the same blunder for centuries—that which brought ruin upon the great nations of antiquity—and is laying the foundations of a fearful retribution by the indulgence of her unbounded ambition and avarice. She is beginning to perceive the difficulties of Imperialism, but does not yet acknowlege her mistake, even when she has her hands more than full of governing foreign races. She cannot expect to make another Rome of herself and not pay the penalty of Rome.

The philanthropical system would put a natural restraint upon national and personal ambition, for nations would be circumscribed by ethnical limits. An Alexander or a Napoleon, a Rome or an England, would be impossible. Weak peoples would not be a standing temptation to the cupidity of the strong, and need stand in no fear of being conquered and absorbed by the first great power which picks a quarrel with them. All nations would be safer and longer-lived. The strong would not be ruined by the indulgence of ambition run mad and the absorption of heterogeneous races, and the weak would be spared from the greed of the powerful. The nations in severalty would have a mutual interest in promoting the cause of ethnical autonomy, and tribal union as well, and would unite to prevent the overreaching ambition of any one nation or ruler. This latter policy is, to a small extent, pursued by the rulers of the nations of Europe, but with the difference that there is no regard paid to the desires of the people. Inter-tribal wars would be matters for general surveillance and arbitration, and coercion of part of a people desiring independence would depend upon the amount of coercion required, cruelty, of course, being out of the question.

But let us illustrate by some cases in point, and observe the probable workings

of the civilizing-protectorate system among peoples. Take the case of the Zulus. They have a perfect system of government, and, except for its cruelty, it works well with them in practice. It is an absolute monarchy, beginning with the head of a family, or *kraal*, and ascending through one series of sub-chiefs after another until all power culminates in a head chief, or king. Through this system the king can make the remotest, lowest subject in the land feel his power. They have a code of laws, prosecute law-suits and settle difficulties between individuals, and between individuals and the governing power, with considerable justice. The system is perfect of its kind, and is capable of great good. The rights of life and property are respected, and large business interests, cattle raising, agriculture, trading, etc., are conducted with success and safety. Suppose now, that after British honor had been avenged by the defeat of the Zulus (which would be right so far), that England should restore their territory and independence and make a treaty with them compelling the king to suppress and prevent cruelty, slavery and oppression among his people, and permit teachers and missionaries to reside among and instruct them; and then let them govern themselves to please themselves. England would, of course, be compelled to maintain a small military force on the frontier or within the kingdom, which would be an expense; but she would be more than compensated by the good done to the people and the safety rendered to British trade. She would, at the same time, be relieved from all the annoyance and expense of governing and administering law to a people she does not understand, whose thoughts and prejudices she does not comprehend. The people would be happier with their own rulers than under a better foreign government—according to European notions—which they do not understand. Can any one doubt the result? In one generation's time the people would be on their way to civilization. They would be happy and prosperous; the natural resources of their country would be developed; wealth would be accumulated, and, in a few generations, with education, the Zulus would become civilizers in turn.

But this glorious consummation we can scarcely ask, much less hope for. The autonomy of the Zulus, which is their birthright as men, must be sacrificed to British ambition and avarice. But if England should, by any fortunate, accidental disregard of precedent, do this grand thing, the result could only be of the happiest, for the Zulus possess a vigor of mind remarkable in savages, owing, doubtless, to their ethnical relationship not being specially negritic.

We are informed that the British commandant sent a protest to King Cettewayo against his cruelty to some of his subjects, some hundred of whom he had murdered for a mere whim. The haughty chief returned a defiant reply that he committed the deed "because it was a custom." Such "customs" should, of course, be interfered with and prevented. Cettewayo is a cruel, barbarous man, and should be restrained; but he is wily and intelligent, and is descended from a capable family, which, but for British dominion and conquest in South Africa, would doubtless have conquered the entire Cape country and established a

XUM

kingdom of some magnitude. The Dutch Boers acknowledged allegiance to them and other native chiefs and flourished under their government.

With restraint and education, Cettewayo's descendants would make good and capable rulers. Therein, and in the education of the people, lies the duty of Christian England to South Africa. If she forfeits this duty, if she prostitutes it to selfish gain, she deserves the anathema of Christian people in this world and just judgment in the next.

Suppose again, going back in history, that Spain had followed this principle in her treatment of the conquered peoples of Mexico and Central and South America, instead of robbing, murdering and destroying them. What interesting nations they would be to-day—how happy they would have been, and what good they might have done in the world by becoming civilizers in turn! But such a state of things could not have been possible then, much as we could desire it to have been so, and much as our blood boils over the indignities, atrocities and cruelties heaped upon the poor natives by the hell-born conquerors "coming in the name of the cross!" God save the mark!

In fact, a most interesting part of the subject is the contemplation of the interesting and picturesque peoples, and the variety there would be among nations, under this system, and of the delightful happiness of every people with customs, institutions and governments native to themselves, and with rulers of their own blood. It is, perhaps, hardly necessary to point to Switzerland, whose people have retained independence and being homogeneous, are happy, interesting, beautiful, and vigorous in mind and body, and having been free and unrestrained, have advanced in mental and physical development in their own way.

The effect of tyranny and foreign oppression is depressing and dwarfing on any conquered people. The effect of freedom being seen in Switzerland, but compare the contrast of Poland, the Slav countries, or Ireland, the victims of conquest and foreign rule. How they have suffered—what struggles they have made for liberty, and what bloodshed and misery these struggles have brought upon them! Scotland is a little better off, for she fought for and obtained certain rights. But suppose all these countries were and had been free and independent; what happy, interesting, and picturesque peoples they would now be! In the contemplation of such things, we do not believe that the principle of racial autonomy could be carried too far. It would fill its natural bounds and go no further.

Bringing matters nearer home, suppose that our own country had carried out this principle in dealing with the much abused and much abusing, "oft reviled and oft reviling," red Indian, the native races of America. This would not have been possible, perhaps, on account of the insurmountable practical difficulculties involved; but, passing these by, suppose our government had given more attention to these poor people, and treated them with something like justice, on the plan we have proposed. Nations might now exist here of whose peculiarities and possibilities the world has never dreamed. But it was not to be so; and, although we cannot restore life to the murdered thousands or return their

great, rich lands to the survivors, we can atone for a fraction of our crimes against the Indian by making some amends to the remnant of his race still living among us. We can do something for them by restoring to them territory and autonomy, by protecting them from themselves and others and educating and elevating them. We can give them the happiness that would be theirs when following their own customs and government. One thing has been pretty clearly demonstrated to our government, one would think, and that is that perpetual misunderstanding and misconception of the character and needs of the Indian will ensue so long as we persist in attempting to rule them as we would people of our own races, who are totally different and at variance with the Indian in almost everything. When the government of the Indian is transferred to his own hands, he will prosper and be happy, and not until then; for he, and he alone, understands the character and knows the needs of the race. The forcing of incomprehensible European civilization and customs upon him will continue to be, as it has been in the past, the one cause of his slow but sure extinction. He cannot adapt himself to them, for he comprehends nothing but the vices of the white man. The latter continues to covet and take the Indian's lands, even of the little that is now left, his avarice being the only excuse for the injustice and wrongs heaped upon these poor defenseless natives. All the benefits which have accrued to the selfish, soulless white man, do not compensate for the sacrifice of national honor and the compromise of every good and right principle.

One opportunity yet remains to our country in which to do justice, according to the civilizing-protectorate system, to a wild, interesting and deserving people. We refer to the natives of Alaska. For ten years since that valuable region came into our possession, the natives have been treated with a shameful neglect, a disgrace alike to our civilization and our Christianity. On the withdrawal of Russian occupation, Russian teachers and missionaries were also removed, and the people have been since criminally left to their own savage instincts. Fortunately, the Alaskans and the Innuits are a mild, intelligent, industrious people, so that they have not been as cruel and abandoned in their actions and treatment of each other as the red Indian would have been under the same circumstances of freedom from restraint. Recently there have been great efforts made by missionaries for their conversion and welfare, and these people respond, not by individuals, but by *whole tribes*, to the call. We have here, in Christian America, a wild and deserving people begging, reaching forth their hands toward us for instruction aud help.

But what will the government do, with all its boasted friendship for suffering people? Just as it did with other wild tribes—let them alone until they revenge a repetition of injuries and wrongs inflicted by unprincipled white men, by murdering a few of them, and then send an armed force against the poor, defenseless Indians and shoot them down like dogs. That is "civilization," according to the Anglo-American idea. But, in the name of humanity and simple justice, why not anticipate the necessity of punishing and destroying them, by sending teach-

ers, missionaries and protectors among them? The Alaskans have a few customs which are cruel and degrading, such as the enslavement of women, which should be interfered with. Some church missionary societies are, however, doing what they can for the redemption of Alaska, and private effort will, we hope, even partially do what devolves upon the general government, rather than leave it undone. The people of Alaska are possessed of an unusual capacity for development, and if the American people would do their duty to them, by the expenditure of a small amount of means and effort, an empire could be erected, by the improvement of the people and the development of the prodigious natural resources of the country, that would be powerful for good and be no mean friend and ally—or dependency, if we must—of our own.

But the American Republic owes an enormous debt and duty to another unfortunate and simple people—a debt for services rendered in involuntary servitude, as well as for injuries inflicted upon and crimes committed against. We refer to the African negro. While we cannot compensate the dead, or even the living, for valuable labor performed as slaves, nor make amends for miseries we have caused, we can, perhaps, make a slight return by endeavoring to benefit those who remain in Africa. The descendants of the slaves living in our midst will, of course, be absorbed by the white population, and in time the race will disappear from this nation, there being now no fresh influx of pure blood. Probably nothing can be done of practical benefit toward isolating the race in America and erecting them into an empire or state by themselves, and they would scarcely accept of it if attempted. They have become affiliated with the Saxon, and absorption is their doom in defiance of state or other interference, and this result will be brought about without cruelty to or objection by them.

But we would call attention to our duty in the way of recognizing our obligations to the race, by attempting something for the good of those remaining in the mother country of the blacks. It would be a grand move for our nation to reach forth and establish civilizing protectorates over various peoples in Africa, to the end of reclaiming them from barbarism and rescuing them from the clutches of European nations now hastening to absorb them It would be a great and philanthropic thing for our government to adopt this policy and to step in, say, in the case of the Zulus, to interfere in their behalf by protesting against their absorption and advising their liberation after conquest, except surveillance as to cruelty and education. It would be a humane departure from our habit of cold indifference to the fate of other peoples and from our selfish policy of non-interference in the affairs of the rest of the world. This policy is a studied disregard of our obligagations consequent upon the possession of power and civilization Our wealth and power mean that they are to be used for the benefit of peoples less fortunate, and imply, by their presence in our hands, our great duty to the savage and ignorant. Our policy of non-interference in the affairs of Europe is justified, perhaps, on the ground of lack of necessity. But non-interference in the affairs of weak, savage peoples, indifference to their crying woes, is not right. Our

duty to the poor African is a palpable one and should be responded to promptly; and no better opportunity could be offered, one more pregnant with possibilities for good, than that of the attack upon Zululand. Our protest would, of course, excite the resentment of England, and the question would be raised of our right to interfere. That part of the ground would need to be fought over, diplomatically, in any attempt at any time. The counter question of the right of Great Britain could then be raised, with great weight in its mere name, to the indiscriminate conquest and annexation of savage and defenseless countries. This could be seconded by our greater right to protest against her further aggrandizement in Africa, and our right to interfere in behalf of the oppressed and weak to the end of saving them from slavery and national death. We could compel her, by our protest, to show cause, and become at least resposible to other nations, for her actions.

It is strange that Turkey should be made to account and suffer for her cruelties, when England is allowed to continue her inhuman policy of the indiscriminate slaughter, conquest and enslavement of wild people. Surely, America has the right, by virtue of her principles of freedom and liberty, to interfere in behalf of the weak. The start once made, persistence in protesting against the policy of conquest by any nation, would undoubtedly bring it gradually to the approval and acceptance of all honest nations. Justice would compel England and other nations to adopt it, and a new era would dawn for weak peoples.

But our nation should inaugurate the practice of the policy by dealing—after doing our duty to the Indian and the Alaskan by way of being consistent—with those African tribes which have been most wronged by American slavery, *i. e.*, the tribes of the western coast. These people should be protected from the encroachment of European nations, and from themselves, and be developed, by the civilizing-protectorate system, into complete, civilized nationalities. The good possible to be done to the people of Central Africa, who are being swept away by the slave traffic and tribal wars, is incalculable, and the demand for immediate interference is most imperative. The appropriateness of America taking the initiative in the inauguration of this progressive and philanthropic principle with Africa's peoples, is at once apparent. We have always claimed to be the champion of the oppressed and the liberator of the enslaved. The call to the downtrodden has been sounded throughout the world, and they have flocked to our shores by millions. Our success in free government has encouraged the development of the republican principle in all nations. Liberty reigns within our borders, and the capability of civilized man for self-government is with us a demonstrated fact.

What, then, can be more appropriate than that we should go further, take another step forward, and give to the world another policy and bequeath another legacy to oppressed humanity? Our championship of it would be merely the discharge of duty, whether it originated with ourselves, or some other nation arose while we slept and stole away the honor of inaugurating it, it would yet be ours to adopt and foster the principle and apply it where conscience should dictate.

XUM

This subject is merely presented as a plea for a new national philanthrophy and the abandonment of the old national selfishness, cruelty and greed. It is merely carrying into a higher field the ordinary claims and duties of universal brotherhood. It is an appeal for national repentance for past misdeeds and for reparation for wrongs and crimes committed. It is a suggestion of the weight of the obligations under which Christian and civilized nations rest, by reason of the possession of those high distinctions. It is an attempt to promulgate the principle that nations must, by all that is good and right, begin to recognize each other's rights. It is the carrying of the principles of Christianity into international politics, and a demand for the inscription of the golden rule at the head of the code of international morals—"Whatsoever ye would that men should do unto you, do ye even so to them."

METEOROLOGY.

INTERNATIONAL METEOROLOGY.

The following extract from the *Monthly Weather Review* of the Signal Service, U. S. A., for the month of July, is published for the information of our readers as showing the rapid advance made in this country on the subject of International Meteorology, under the enlightened direction of General Myer. We hope at an early date to lay before the readers of this magazine specimens of the several maps referred to.—ED.

WORLD WEATHER CHARTS—*Meteorological Charts of the Northern Hemisphere.*—It has been the plan of these charts that they should be based upon observations taken simultaneously by day and at night, on land and at sea. The observations to be those of the barometer, thermometer, weather, etc., had everywhere on the globe at the same fixed instant of physical time—that is, for example, observations so arranged that those at Washington, St. Petersburg, Constantinople, etc., are taken, not at the same hours of local or clock time at those cities, for they would not then be taken at the same moment, but so arranged that the readers or observers are actually at the instruments at once, all reading and recording at one and at the same moment the readings and records are being made at every other station, and so for all places. The atmosphere over any extent of the earth can thus be viewed as a whole and at once, before any movements in it are possible. The resulting charts give a true synopsis—in effect a photograph of the atmosphere and its conditions at the instant. Such observations are known as *Simultaneous Observations.* They are characteristic of the work of this office. They were for the first time practically employed by it for purposes of prediction in 1870. Simultaneous observations as thus described are, upon the invitation of

the United States, widely taken throughout the world. They are collated at this office, printed and issued daily, forming "The International Bulletin of Meteorological Observations taken Simultaneously." The International co-operation embraces observations taken by almost every civilized power north of the equator, and observations taken at sea.

Four charts, based upon International Meteorological Observations, taken simultaneously, are issued with the July *Review*. These charts have been specially prepared. The subject of the preparation of such World Charts is referred to in the Annual Report of the Chief Signal Officer for 1878, and in preceding reports. They embrace within their limits the Northern Hemisphere.

Chart No. IV is based on the *Bulletin of International Meteorological Observations*, taken at 7:35 a. m., Washington mean time, under date of December 26, 1878, and exhibits in graphic form the barometric pressure and temperatures over the Northern Hemisphere so had for that date and hour. Lines of equal barometric pressure and equal temperature are charted, and their values are expressed in French and English measures. Extended areas of high pressures and marked barometric depressions are respectively indicated as High, Higher, Highest, and Low, Lower, Lowest. This map presents the data of the bulletin for the day charted for study. It is a map of the Northern Hemisphere, and is charted daily.

Chart No. V is based on the *Daily International Weather Charts* and *Daily Bulletin of International Meteorological Observations*, taken simultaneously for December, 1877, and shows the mean isobars, mean isotherms, mean velocity and prevailing direction of the wind at 7:35 a. m., Washington mean time (0:43 p. m., Greenwich mean time), for that month, as deduced from the simultaneous observations received at this office. The values of the lines are given in French and English measures. Isolated means, when barometric, are expressed in English inches, and when thermometric, in degrees of Fahrenheit. The chart is one of the Northern Hemisphere.

Chart No. VI is based on the *Daily International Weather Charts* and *Daily Bulletin of International Meteorological Observations* for December, 1877, and shows the movements of the *Centers of Low Barometer*, as charted from day to day for that month, and also the lines of equal precipitation (rain and melted snow), as deduced from U. S. Signal Service observations and those of co-operating international observers. Arabic numerals show the location of the center of Low Barometer at 7:35 a. m., Washington mean time (0:43 p. m., Greenwich mean time), on the day of the month having a similar number. Lines of equal rain-fall are given in both French and English measures. Isolated rain-falls, without the continuous lines, are expressed in English inches. The chart is one of the Northern Hemisphere.

Chart VII is based on International Simultaneous Observations received to date, on United States Signal Service observations and on marine and other reports received from voluntary observers. It shows the movements of the centers of the most definitely marked areas of Low Barometer of recent date. The tracks

in black have been charted in previous *Reviews* in connection with the storms of the United States, and the tracks as subsequently determined are charted in red. The subject of Ocean Storm Tracks, and the connection of them with storm tracks on land, is expressly considered in the preparation of these charts. A table of the wind velociti s accompanying the storms, both on the European and American coasts, is printed upon the chart. The chart is one of the Northern Hemisphere.

In order to satisfy the many inquiries concerning the condition, scope and progress of the labor connected with the International Simultaneous Observations, there is herewith published an extract from the Annual Report of the Chief Signal Officer to the Secretary of War, dated November 1, 1878, wherein are sufficiently set forth the origin of the work, its plan, the co-operation it has received from distinguished co-laborateurs, its progress, scope and purposes, as follows:

The proposition adopted at the congress of persons charged with meteorological duties, assembled at Vienna in 1873, and to the effect that it is desirable, with a view to their exchange, that at least one uniform observation, of such character as to be suited for the preparation of synoptic charts, be taken and recorded daily and simultaneously at as many stations as practicable throughout the world, has continued to have practical effect.

By authority of the War Department, and with the courteous co-operation of scientific men and chiefs of meteorological services representing the different countries, a record of observations taken daily, simultaneously with the observations taken throughout the United States and the adjacent islands, is exchanged semi-monthly. These reports are to cover the territorial extent of Algiers, Australasia, Austria, Belgium, Central America, China, Denmark, France, Germany, Great Britain, Greece, Greenland, Iceland, India, Italy, Japan, Mexico, Morocco, The Netherlands, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Tunis, Turkey, British North America, the United States, the Azores, Malta, Mauritius, Sandwich Islands, South Africa, South America, and West Indies.

On July 1, 1875, the daily issue of a printed bulletin, exhibiting these international simultaneous reports, was commenced at this office and has been since maintained. A copy of this bulletin is furnished each co-operating observer. The results to be had from the reports thus collated are considered to be of especial importance. The bulletin combines, for the first time of which there is record, the labors of the nations in a work of this kind for their mutual benefit. There is needed only the assistance to be had from the naval forces of the different powers (that of the navies of the United States and of Portugal being, as heretofore related, already given to extend the plan of report upon the seas) to bring more fully within the scope of study observations practically extending round the Northern Hemisphere. This end is to a great extent already attained.

In this connection the office has to acknowledge the cordial and valuable co-operation of the meteorological services of the different countries, represented as follows:

Algiers, by General Teissier, Commandant Supérieur du Génie; Austria,

by Prof. Dr. Julius Hann, Director of the Imperial Royal and Central Meteorological Institute at Vienna; Belgium, by J. C. Houzeau, Director of the Royal Observatory at Brussels; Costa Rica, by Señor Frederico Maison, Director of the Central Office of Statistics and Meteorology; Denmark, by Capt. N. Hoffmeyer, Director of the Royal Danish Meteorological Institute at Copenhagen; France, by U. J. LeVerrier, Director of the Paris Observatory, Prof. E. Mascart, Director of the Central Meteorological Bureau of France, and the respective observers; Germany, by Prof. Dr. Geo. Neumayer, Director of the German Naval Observatory, Hamburg; Great Britain, by Robert H. Scott, Esq., F. R. S, Secretary of the Meteorological Council, London, Alexander Buchan, M. A., F. R. S. E., Secretary of the Scottish Meteorological Society, Edinburgh, and the respective observers; Greece, by Prof. Dr. J. F. Julius Schmidt, Director of the Royal Observatory at Athens; India, by H. F. Blanford, Meteorological Reporter to the Government of India; Italy, by the Minister of Agriculture, Industry and Commerce, and the respective observers; Japan, by the Imperial Meteorological Observatory, and the Imperial University of Tokei, Japan; Mexico, by Señor Mariano Barcena, Director of the Central Meteorological Observatory in the City of Mexico, and the respective observers; Netherlands, Prof. Buys Ballot, Director of the Royal Meteorological Institute of the Netherlands at Utrecht; Norway, by Prof. H. Mohn, Director of the Royal Norwegian Meteorological Institute at Christiana; Portugal, by J. C. de Brito Capello, Director of the Meteorological Observatory of the Infante Don Luiz at Lisbon; Russia, by Prof. H. Wild, Director of the Imperial Central Physical Observatory of Russia at St. Petersburg; Spain, by Antonio Aguilar, Director of the Royal Observatory at Madrid, and the respective observers; Sweden, by Prof. R. Rubenson, Director of the Royal Swedish Meteorological Institute at Stockholm, and Dr. H. H. Hildebrandson, Chief of the Meteorological Division of the Upsala Observatory; Switzerland, by Prof. R. Wolf, Director of the Observatory at Zurich, and Prof. E. Plantamour, Director of the Observatory at Geneva; Turkey, by A. Coumbary, Effendi, Director of the Central Observatory at Constantinople, and Prof. C. V. A. Van Dyck, Superintendent of the Lee Observatory at Beirut; Australasia, by Francis Abbott, Directory of the Meteorological Observatory, Hobart Town, Tasmania, and R. L. J. Ellery, Director of the Meteorological Observatory at Melbourne, Victoria, Australia; Canada, by Prof. G. T. Kingston, Director of the Magnetic Observatory, at Toronto, and Superintendent of the Meteorological Office of the Dominion of Canada, and the respective observers; United States Navy, by the Navy Department, through Rear Admiral Daniel Ammen and Commodore W. D. Whiting, U. S. N., Chiefs of the Bureau of Navigation, and by individual observers at other points.

The office has to regret the death, since the date of the last annual report, of four co-laborers in the work, Urbain Jean Joseph LeVerrier, Director of the Paris Observatory; Prof. Ernest Quetelet, Director of the Royal Observatory at Brussels; Prof. Edward Heis, of Münster, and Prof. Pietro Angelo Secchi, of Rome.

A number of observations taken on vessels at sea to complement the sychronous reports of the service, and at the request of the Department, have been received on the form provided for the purpose. Their utility is evident in the study of storms approaching our coasts or which endanger vessels from our ports.

The co-operation of the Navy of the United States in the taking of observations simultaneously with the system adopted at this office, wherever naval vessels of the United States may be, as assured by the general order of the Secretary of the Navy, dated December 25, 1876, has largely increased the data of this class. This co-operation has been skillfully rendered by the Navy Department and United States Navy, through the Chief of the Bureau of Navigation.

The people of the United States are thus the first nation whose army and navy co-operate, as all armies and navies should, under official orders, in the taking of simultaneous observations, wherever the forces may be.

In view of the existence of the system of simultaneous reports to be made at sea by the vessels of the naval and commercial marines of the United States and other nations, and to provide for its extension, carefully tested barometers of the best make have, since the date of the last annual report, been prepared and located, as standards, at the ports of New York and San Francisco.

These barometers have been publicly located to afford means of comparison of the ships' barometers of the shipping of all nations. The instruments, while carefully guarded, are easily accessible. Public notice is given of the location, and a Sergeant of the Signal Corps attends to give information and to take charge of any ship's barometer which may be brought for comparison.

The standard barometer for the use of shipping on the Atlantic Ocean is located at the Maritime Exchange, in New York City; the standard barometer for the use of shipping on the Pacific Ocean is located at the Merchants' Exchange, in the city of San Francisco

The officers of the Signal Service at the different cities and ports of the United States and upon the sea coast offer every facility and aid within their power to the vessels of any nation.

With the plans for charting now adopted at this office, and with the reports now received here, it appears that the meteoric changes occurring over a great portion of the continents north of the equator can be charted with an accuracy sufficient to permit careful and valuable study. This charting, to be of the best attainable value, must be supplemented from the records of observations had on the seas. A ship at sea becomes one of the best of stations for a simultaneous system. The value of the record is enhanced by the change of the ship's location occurring within each of the twenty-four hours. There is no sea-going vessel but that carries human life, and each ought to carry, by compulsion, if need be, meteorological instruments. The smallest craft, in caring for its own safety, may use them enough to add to the value of the most extensive record. There is no nation without interest in the work proposed to be based upon exchanged simul-

taneous reports, and none has hitherto hesitated, when the subject has been properly presented, to aid in a duty which, so easily done as to require very little effort on the part of any one person, has for its object a good to mankind. The work cannot, from its nature, be for the selfish good of any section.

A number of the great steamship companies, foreign and domestic, operating the principal commercial sea routes, have promised and will give their powerful influence and aid.

The office has the co-operation of the Pacific Mail Steamship Company, through its agents, Williams, Blanchard & Co.; the White Star Line, through its agents, Ismay, Imrie & Co., Liverpool, and R. J. Curtis, New York; the Occidental and Oriental Steamship Company, through its President, George H. Bradbury; the North German Lloyd, through its agents, A. Schumacher & Co.; the American Steamship Company, through its President, H. D. Welsh; the Red Star Line, through its President, James A. Wright; and the Allen Line, through its agents, A. Schumacher & Co.

The United States bear, in the cases of all maritime observers co-operating in this system, all expenses for forms, postages, etc., when so desired, and not infrequently, and, when necessary, loan the required instruments.

The number of observations made daily on separate vessels at sea is one hundred.

Even if predictions are not directly practicable, research has already gone far enough to indicate the paths through which to learn what sequences will be found on our own western coasts, consequent on conditions reported as existing on or near the eastern coast of Asia or on the Pacific Ocean.

Similar studies will have reference to our own southern and eastern coasts and to the western coast of the European Continent. The time cannot be far distant when vessels leaving any Atlantic port may be informed whether any notable disturbances exist at sea, and where it is likely to threaten the voyage.

The establishment of permanent ocean stations in lines traversing the oceans over or near the telegraphic cables, and in telegraphic communication with either continent, is not considered impracticable, and has been referred to in a preceding report.

There is reason to hope that a progress has been made which will eliminate from the study of practical international meteorology some of the difficulties hitherto encountered.

There are grounds to hope, also, that the atmospheric conditions and changes of condition can be charted with sufficient accuracy over any extent of the earth's surface. If the hope has fruition, meteorological barriers will, as against study, practically cease to exist.

While the stations are crowded in some localities, each is useful—each serving to check the work of the other, and each aiding to close the gaps the failure of the others might sometimes cause. The work is not likely to be abandoned by those in the different countries who have taken part in establishing it, and who

share its benefits. If it served no other purpose than to maintain, as it does, the pleasant co-operation of those charged with the meteorological duties of the different countries, it would be of value. It is hoped that, by systems of observations thus extensive, generalizations may be had to permit the announcement of meteoric changes for periods longer in advance than have been hitherto practicable.

The average number of daily simultaneous observations now made in foreign countries is two hundred and ninety-three. The total number of stations on land and on vessels at sea from which reports are entered in the bulletin regularly, is five hundred and fifty-seven. The co-operation of the different nations, secured by this plan of exchange, as above described, renders the additional cost to the United States, of the grand system of reports it makes possible, but little more than that of the cost of the preparation, paper, and binding of the International Bulletin and the accompanying charts, a cost which would have to be met in great part for the proper preservation of the records themselves, even if the bulletins were not distributed.

The Chief Signal Officer is gratified to announce in his report that the work of the collection of the reports of International Simultaneous Observations, carried on in foreign countries in co-operation with the United States, as well as within the Territories of the United States and upon the seas, thus above referred to, has, in the year just passed, so far progressed as to have attained one principal result for which it was set on foot. On July 1, 1878, it became possible, for the first time in the history of this office, to commence the issue, on that date, of a daily international weather map, charted daily and issued daily, each chart based upon the data appearing upon the International Bulletin of Simultaneous Reports of similar date. The charting extends around the world, and embraces for its area the whole Northern Hemisphere.

The daily issue of a chart of this kind, thus daily issued for the first time by the United States, is without a precedent in history. It exhibits the co-operation, for a single purpose, of the civilized powers of the world north of the equator.

The studies of such charts make possible the improvement which will come as the work progresses and the area of the chart is better filled with reports of observations carefully elaborated, and they are fully appreciated by scientific men.

The questions as to the translations of storms from continent to continent, and of the times and directions they may take in such movements; the movement of areas of high and of low barometer; the conditions of temperature, pressure and wind-direction existing around the earth at a fixed instant of time, permitting thus the effects of day and night to be contrasted; the distribution and amount of rainfall, and other studies, many and valuable, only suggested by this enumeration, may be by such studies settled. It seems not impossible that in the future questions of climatology, and perhaps others bearing upon the prediction of weather changes far in advance of the time at which these changes may happen, or questions of the character of coming seasons even, may be answered by the researches these charts will make practicable.

The very great aid and material furnished in this elaborated form gives to the search for generalization, or for data in the support of theories, was referred to in the last annual report. In frequent cases little more than collation is necessary.

As a means of better combining the work and the interests of the several nations; of certainly securing that co-operation at sea which will enable the lines of the charting to be drawn as fully and as well over oceans as over continents; and which will give the world ultimately a knowledge as practical of the movement of areas of disturbance in the midst of the seas as is now had of such movements on some continents, the undertaking is of much importance.

It is an advantage of the charting draughted from simultaneous reports that studies by normals, not possible in any other way, can be made. The normal pressure, temperature, &c., arrived at from observations taken at any one place, at the same and a fixed instant of time every day, become established as to that place and time with accuracy.

Many causes of error are eliminated.

The inter-comparison of these normals with the normals taken at other places simultaneously with the first and under the similar condition that the normals to be found by those places are to be from observations taken at those places at a fixed time and on every day, gives results reliable, and differing from those to be had by the use of normal readings arrived at in any other manner. Normals for the year, for the season, and for the month may be determined by such procedure. The comparison of such normals will show in the case of abnormal changes in any district or section, for any season, whether and how they are compensated by compensating variations elsewhere. There are interesting studies as to what sequences there may be to follow such atmospheric variations occurring over any region or country—either in that region or country or elsewhere—and how and where the compensating variations occur, and with what concomitants or sequences of meteoric changes.

There is the hope to gain in this way, or by investigations which such study will suggest, information to benefit the commercial and agricultural interests of the world.

There is the further hope that as it is more fully realized by the different peoples, how close in the future the practice of such investigations draws, each member of the family of nations will find its own interests in labors of this description, and draw more closely the bonds and join with energy in a work which has so begun to connect them. The undertaking, world-wide in extent, is capable of rendering a world-wide benefit."

Maps based upon a single simultaneous observation, taken daily, demonstrate what may be expected when more frequent observations are attainable, and the daily period of twenty-four hours may be exactly divided by the intervals at which such observations are taken.

It is by the study of charts of the character of those herewith described and referred to, the practical solutions of the great questions of Ocean and Continental Meteorology, and possibly some prevision of seasons, may be hoped to be arrived at.

XUM

LAWS OF ATMOSPHERIC ELECTRICITY.

Atmospheric electricity presents daily in Piedmont two maxima following the rising and setting of the sun, at an interval of some hours. These two maxima are separated by a minimum which follows the passage of the sun over the meridian of the place. As regards the annual fluctuation, the maximum value of the atmospheric tension falls in February, and the minimum in September. Before and after storms the electrometer always marks zero, but during their passage or proximity the tension is very great. Rain and snow increase tension more slightly, and are often preceded and followed by electric diminution. The action of fogs, hoar frosts, and of the formation of clouds increases atmospheric electricity, though to a less extent than that of rain and snow. In calm and hot weather the lowest values are observed. South, and especially southeasterly, winds increase the electricity of the air; north winds have an opposite effect. Rain and snow are accompanied by negative electricity, at least as often as by positive. The same proportion holds good for storms and to a less extent for rain and snow. Negative electricity is generally due to storms or rain at a distance, to the formation of clouds, or to a polar aurora. In the normal conditions of the atmosphere electric tension decreases with altitude.—*P. F. Denza.*

METEOROLOGICAL IDIOSYNCRASY OF THE AMAZON BASIN.

EDWIN R. HEATH, A. M., M. D., SAN ANTONIO, BRAZIL.

The determination of elevations above the sea, by means of instruments which measure atmospheric pressure, has of late years become one of the many duties of a scientific traveler.

The accuracy of Barometrical and boiling point Thermometrical leveling, compared with known levels, has justly raised it to a scientific branch. However reliable it may be generally, an exception must be made, at present, with regard to that part of South America from the foot of the eastern slope of the Andine chain eastward, comprising all the country drained by the Amazon River and its tributaries.

Here, elevations given by reliable travelers vary (for the same place), from 250 feet below sea level to 1475 feet above. Prof. Agassiz says: "The barometer cannot be depended upon to determine elevations on the Amazon." A fact so at variance with other places proves either want of accuracy in our instruments or a need of more careful observations by travelers. For six months we have made a speciality of the atmospheric changes; monthly records of which have been forwarded to the Smithsonian. A summary of these is included in this article, also in tabular form the elevations of various places on the Amazon and river Madeira, with Barometric or Thermometric readings from which the elevations were obtained, the traveler's name and date of observations.

LOCALITY.	ALTIT'.	MERC. BAR.	ANEROID.	BOIL'G P'T THERM.	OBSERVER.	
Mouth of River Napo .	385	29.526		211.4°	James Orton.	River Amazon.
Nauta	365				Castleman.	
	345	29.510		211.1°	J. Orton.	
Pebas	537			211.1°	Herndon.	
Loreto	345			211.4°	J. Orton.	
San Antonio	256	29.655				
	255	29.656		211.5°	J. Orton.	
	670				Spix and Martius.	
	150				Azevedo and Pinto	
Tabatinga	200				Agassiz.	
	138	29.770			J. Orton.	
Tunantins	124				Azevedo and Pinto	
	100	29.813		211.9°	J. Orton.	
	2052			208.2°	Herndon.	
Ega.	120				Azevedo and Pinto	
	199	29.705			J. Orton.	Negro.
Barra or Mundos on the River Negro .	1475			209.3°	Herndon.	
	293				Castelnau.	
	556				Spix and Martius.	
	92				Azevedo and Pinto	
	−253			212.5°	Wallace.	
Mouth of River Madeira.	442.83			210.87°	Gibbon.	
	69		30.930		Keller.	
	158	29.752			J. Orton.	
	84				Azevedo and Pinto	
Serpa	59		30.+		Keller.	
	114	29.802			J. Orton.	
	58				Azevedo and Pinto	
Obidos.	45				Agassiz.	River Amazon.
	107	29.808		211.5°	J. Orton.	
	846			210.5°	Herndon.	
Santarem	50				Azevedo and Pinto	
Mont Alegre	83	29.834			J. Orton.	
	38	29.890			"	
Gurupà	42				Azevedo and Pinto	
	15	29.889		211.95°	J. Orton.	
		29 914			J. O. reduced to level of River.	
	320	29.708		211.5°	Herndon.	
	35				Azevedo and Pinto	
Parà.	35	29.977			Dewey.	
Atlantic Ocean . . .	−2	29.932		212.16°	J. Orton.	
Borba	442.8			210.87°	Gibbon.	River Madeira.
Manicorè	92				Keller.	
Bætas	131				"	
Tras Casas	164				"	
Ilhado Salemaò . . .	174				"	
Domingo Leigue . .	177				"	
Mouth River Jammary	184				"	
Is. Tamandua. . . .	442.8		Keller.	210.87°	Gibbon.	
Rapids San Antonio . .	200				Keller.	
" " " .	750	29.150			Heath, mean of 3 mos.	

SAN ANTONIO, RIVER MADEIRA, BRAZIL, S. A., FEBRUARY, 1879.

Date.	Height of Water in the River.	Rainfall.	Thermometer.		Weather.				7 A. M.		12 M.		6 P. M.		9 P. M.	
			Max.	Min.	7	12	6	9	Merc. Bar.	Ther.	Merc. Bar.	Ther	Merc. Bar.	Ther.	Merc. Bar.	Ther.
1	. . .	.180	80	72	R	R	C	C	29.162	76	29.131	82	29.120	78	29.122	78
2	. . .	.080	90	72	C	C	C	R	29.020	76½	29.114	87	29.000	83	29.100	79
3	170.360	.070	91	72	C	C	C	C	29.191	76	29.121	91	28.962	88½	29.084	79½
4	. . .	. .	92	72	C	C	C	C	29.172	77	29.062	91	28.994	88	29.082	83
5	. . .	.450	94	74	O	C	C	C	29.133	78	29.023	88	28.920	87	29.002	82
6	169.365	.340	90	73	C	P	C	C	29.131	77	29.040	89	28.991	82	29.024	80
7	. . .	.050	90	72	C	C	C	C	29.150	77	29.024	91	29.023	82	29.084	78
8	. . .	.645	84	73	C	P R	R	C	29.131	78	29.071	83	29.082	77	29.113	77
9	. . .	.865	88	72	O	C P	C P	R	29.154	76	29.062	87	29.004	86	29.101	79
10	172.725	.040	88	72	R	C	C P	C	29.222	75	29.131	87	29.070	80	29.152	78
11	. . .	.010	86	74	C P	O	C	C	29.184	76	29.141	84	29.001	89	29.131	80
12	. . .	.410	88	74	C	C	C	C	29.141	77	29.112	89	28.964	87	29.092	81
13	172.990	.230	88	74	C	O	R	C	29.142	76	29.120	86	29.003	84	29 103	79
14	. . .	.460	93	74	C F	C	C	C P	29.152	78	29.121	86	28.983	88	29.070	83
15	. . .	.030	88	74	R	R	C	O	29.200	76	29.200	78	29.071	80	29.113	77
16	. . .	.070	85	70	O	C	C	C	29.164	75	29 022	89	29.071	80	29.044	80
17	178.465	.380	86	71	C F	R	C	C	29.141	77	29.120	84	28.993	86	29.042	81
18	. . .	. .	88	73	C	R	B	B	29.174	77	29.161	86	28.992	86	29.102	79
19	. . .	.625	91	74	C	C	O	O	29.163	77	29.131	87	29.011	88	29.074	83
20	179.209	.880	92	72	O	O	O	O	29.162	78	29.141	85	29.071	78	29.140	77
21	. . .	. .	86	72	O	B	O	R	29.200	75	29.162	82	29.056	83	29.113	79
22	. . .	2.100	85	70	O	O	O	O	29.212	76	29.192	84	29.140	77	29.152	76
23	. . .	.190	88	72	O	C	B	B	29.250	77	29.100	89	29.094	85	29.140	80
24	180.134	. . .	84	72	C	C	O P	O	29 190	74	29.122	81	29.080	83	29.083	77
25	. . .	. . .	88	72	O	R	O	O	29.154	75	29.103	88	28.941	86	29.092	81
26	. . .	. . .	92	74	C	R	O	O	29.090	75	29.074	90	29.012	85	29.064	82
27	. . .	1 010	86	74	C	C	R	R	29.090	78	29.103	79	28.993	84	29.050	80
28	180.404	1.130	88	74	C	C	R	R	29.084	77	29.052	88	29.043	82	29.101	78

METEOROLOGICAL OBSERVATIONS MADE AT SAN ANTONIO, (RIVER MADEIRA) BRAZIL, S. A., FOR MAY, 1879, BY E. R. HEATH, A. M., M. D.

Date	Height of Water in the River.	Rainfall.	Thermom'r.		Wind								Weather.				Aneroid in feet.				7 A. M.		12 M.		6 P. M.		9 P. M.	
					Direction.				Force.																			
			Max.	Min.	7	12	6	9	7	12	6	9	7	12	6	9	7	12	6	9	Mer. Bar.	Th.	Mer. Bar	Th.	Mer. Bar	Th.	Mer. Bar.	Th.
1	175.724	. .	88	71	O	SS E	O	O	O	5	O	O	O	C	B C	B	1100	1150	1095	1110	29.273	75	29.231	86	29.174	83	29.240	77
2	. . .	. .	91	70	S	SE	O	O	O	2	4	O	B C	C	C	C	1110	1110	1100	1150	29.263	73	29.251	85	29.172	85	29.214	78
3	. . .	. .	94	72	O	S	O	O	O	2	O	O	B C	B C	C	C	1130	1120	1210	1150	29.260	72	29.241	86	29.173	84	29.204	78
4	. . .	.010	91	73	O	E	O	O	O	1	O	O	C	C	C	C	1150	1165	1250	1200	29.253	72	29.212	88	29.134	83	29.163	79
5	172.979	. .	91	71	O	NE	O	O	O	1	O	O	O	C	C	C B	1175	1175	1250	1200	29.220	77	29.210	87	29.133	83	29.170	77
6	. . .	. .	91	73	O	E	SE	SE	O	3	3	1	B	C	P	C	1175	1175	1250	1125	29.211	73	29.252	89	29.140	85	29.224	78
7	. . .	.296	91	73	O	S	O	E	O	3	O	1	C O	C	O	P	1150	1200	1225	1150	29.204	76	29.181	91	29.132	82	29.180	79
8	172.349	. .	89	69	O	SE	S	O	O	4	1	O	O	C	B C	B C	1150	1125	1110	1175	29.252	75	29.221	87	29.164	83	29.210	78
9	. . .	. .	90	67	O	SE	SE	O	O	4	1	O	B	B	B	B	1110	1075	1150	1100	29.280	72	29.281	86	29.201	82	29.253	77
10	. . .	. .	91	71	O	SW	SW	O	O	2	1	O	B	B C	B	B	1100	1090	1175	1150	29.302	68	29 291	86	29.203	82	29.241	76
11	. . .	.358	91	71	O	N	O	O	O	2	O	O	O C	P	O	C B	1110	1110	1170	1110	29.282	74	28.250	85	29.203	79	29.253	78
12	169.479	.189	91	73	O	N	O	O	O	2	O	O	F	C	P	O	1100	1140	1150	1100	29.290	75	29.232	90	29.210	84	29.261	79
13	. . .	. .	88	68	O	E	O	O	O	2	O	O	O	P	B	B	1090	1075	1150	1110	29.284	75	29.300	87	29.254	83	29.230	78
14	. . .	. .	90	66	O	E	E	O	O	2	1	O	B	B C	B	B	1075	1100	1150	1110	29.330	70	29.274	88	29.244	82	29.251	75
15	170.414	. .	85	69	O	E	E	O	O	3	1	O	P	B	B	B	1090	1090	1190	1150	29.322	67	29.270	88	29.191	84	29.240	74
16	. . .	. .	85	72	O	E	E	S	O	1	1	1	B C	O	B C	C R	1075	1050	1150	1075	29.311	72	29.322	87	29.240	83	29.260	78
17	. . .	.064	90	70	O	W	O	O	O	2	O	O	B	P	C	B C	1100	1090	1125	1095	29.291	74	29.292	88	29.244	79	29.293	74
18	. . .	. .	86	72	O	E	E	E	O	6	1	1	C	P	O	C	1090	1100	1175	1110	29 301	73	29.274	86	29.191	80	29.233	75
19	167.439	.006	88	72	O	W	W	O	O	1	1	O	O	C	C	O	1100	1100	1175	1120	29.290	74	29.264	88	29.200	80	29.250	78
20	. . .	. .	91	72	E	W	W	O	1	3	1	O	P	C	C	B	1120	1110	1220	1150	29.260	75	29 251	89	29.160	83	29.223	79
21	. . .	.050	90	71	O	W	O	O	O	2	O	O	C	P	C	B C	1150	1175	1205	1150	29.262	75	29.200	88	29.164	78	29.222	75
22	164.889	.002	90	72	E	E	O	O	1	3	O	O	F	B	B	B	1175	1190	1270	1225	29 240	73	29.220	87	29.121	83	29.161	78
23	. . .	.065	87	72	O	W	W	O	O	3	1	O	C	P	C	C	1160	1200	1250	1200	29.222	75	29.184	90	29.140	82	29.174	78
24	. . .	. .	89	70	O	W	O	O	O	1	O	O	F	O	O	O	1150	1150	125(	1150	29.260	75	29.230	86	29.133	82	29.204	79
25	. . .	. .	80	72	E	E	E	E	3	5	2	1	O	C	O	O	1120	1110	1200	1110	29.263	72	29.263	84	29.184	79	29.231	76
26	162.559	. .	84	59	O	E	E	E	O	4	3	8	C	C	C	O	1100	1075	1020	1000	29.312	75	29.314	82	29.293	76	29.384	71
27	. . .	. .	82	60	E	E	E	E	1	3	1	1	C	B	C	O	950	975	1000	950	29.505	62	29.451	76	29 281	76	29.500	72
28	. . .	. .	82	60	E	E	E	E	1	4	1	1	B	B	B	B	990	1000	1050	1050	29.463	67	29.462	79	29.320	75	29.374	68
29	160 935	. .	86	62	E	E	E	E	1	1	1	1	B	B	B	B	1090	1125	1125	1110	29.432	60	29.290	82	29.270	73	29.320	68
30	. . .	. .	88	62	E	E	E	E	1	1	1	1	B	B	B	B	1025	1035	1075	1050	29.431	60	29.360	83	29.313	77	29.343	72
31	. . .	. .	83	63	E	SE	E	E	1	3	1	1	B	B	B	C	975	990	1050	1025	29.471	60	29.410	80	29.353	77	29.384	73

Orton and Keller made their observations in 1867, (Orton with a Mercurial Mountain Barometer graduated to 10,000 feet; Keller with two Aneroid Barometers). Castelman in 1846; Spix and Martins in 1820; Azevedo and Pinto from 1862 to 1864; Wallace 1848 to 1857; Herndon and Gibbon in 1852, (with Mercurial Mountain Barometers). Gibbons' boiling point was the same for all points on the Madeira river below the rapids of San Antonio and at Manavo, showing a uniform pressure of the atmosphere for a distance of 670 miles and over, and from October 3rd to 25th *i. e.*, twenty-two days. Unfortunately we have no record of the barometer or thermometer by Castelman, Azevedo and Pinto, or Spix and Martins, only the recorded elevations.

Keller was a German civil engineer in the employ of the Brazilian Government, and sent to explore the river Madeira. The records for February and May, 1879, which I inclose of observations made by myself, speak for themselves, and are made with great exactness and with reliable instruments. San Antonio is on the river Madeira 560 miles above its mouth, in south latitude 8° 48′ 14″, longitude west of Greenwich 63° 55′ 05″, compass variations 5° 56′ E.

We have shown the months of February and May since they were the months in which the barometer was the lowest and the highest, February marking 28.9 inehes and May 29.5 inches. From February to June inclusive the mean barometric reading was increasing from 28.9 to 29, 29.1, 29.2, 29.3, June being rather over 3 tenths than under. From these notes one can readily see the discrepancy that would arise from observations made by travelers happening to arrive here at these different months. The aneroid barometer from which the observations in feet are recorded in the May report is a costlv one, and proved many times on the railroads in Peru, always reading within fifty feet of known levels on going from the coast to elevations 16,000 and 18,000 feet and returning. The mercurial barometer with thermometer attached is a mountain barometer, capacity of 10,000 feet elevation, and known as Smithsonian B, made by James Green, New York City, (No. 1608). The weather and wind symbols are after Bowditch. During the months of February, March and April the wind varied in direction and force according to local causes and passing showers, there being no time one could say it had a determinate direction. May 1 the wind took a steady course for a number of days, that is we had a regular breeze which did not depend on local causes.

Before May the atmospheric pressure remained the same before, during and after the passage of a shower, although accompanied by a sharp blow, a dead calm both preceding and following the shower; but no sooner did the May breeze spring up than the barometer showed the change in atmospheric pressure, as it increased or decreased in force. As a rule the nights are so calm that observations can be made with the artificial horizon uncovered without the least particle of motion of the mercury.

The country is nearly level and covered with a dense tropical forest which covers it to the depth of 200 feet and over. Light and air seldom penetrate this covering, so that motions of air above the tree tops would be little felt on the

ground beneath. The river-bed is generally from twenty to fifty feet still lower, and it is from the river-level most calculations of elevations are made. But at this point the ground is hilly and clearer, so that currents of air can reach all parts, although in eddies. The river rises and falls from forty-five to fifty feet although over a mile in width. It reached its highest point this year March 13th.

We present below in tabular form the amount of rainfall, number of days in which rain fell, mean of the maximum and minimum thermometers, and highest and lowest point reached by the thermometer at this place during the first six months of the year 1879.

MONTH	RAIN FALL	No. days Rain Fall.	THERMOMETER.		THERMOMETOR.	
			Highest	Lowest	Mean Max	Mean Min
January	15.000 in.	23	97°	70°	87.966°	72.666°
February	10.245	22	94	70	88.150	72.571
March	16.412	24	94	70	87.903	71.903
April	11.399	21	94	68	88.440	72.100
May	1.040	9	94	59	88.161	68.999
June	2.315	5	93	62	90.033	69.233

The height of the water in the river in February and May reports is calculated from station zero of the Madeira and Marmoré railroad, assuming it to be 200 feet above sea level. From 8 A. M. to 4 P. M. the thermometer generally ranges from 86° to 94°, and days in which the air is a perfect calm the heat is very oppressive, prostrating one's energy, and planting seeds of biliousness, bilious remitting fevers, agues and jaundice. One peculiar effect is to make the nervous system excessively acute, so that every one passes the night as if under the effects of a strong cup of tea or coffee, making the bladder very irritable, inflaming the kidneys and prostate gland, irritating the stomach so that many die from vomiting. The mortality on the river from bilious remitting fevers and pleuro-pneumonia has been heavy except at San Antonio. Cramps in the calves of the legs, paralysis, neuralgia and rheumatism, and ring-worms are universal. Vampire bats and mosquitoes by night and sand flies, ants, wasps, sweat bees, and a minute red mite are the pests to man presented by the climate and vegetation, while mold destroys everything during the rainy season. There are two kinds of sand-fly, the Pium and Maruim, as they are called here, while the mite which is microscopic before and red after being gorged with blood, is called Mucuim. In so short a time it is impossible to collect information which would be exhaustive. The May and February records will show the general daily variation of the atmosphere. We hope in the future to present data sufficient to assist in placing the barometer in its rightful position of "leveler" even in the tropics.

THE NOVEMBER METEORIC SHOWERS.

PROF. J. H. TICE.

A few days after the occurrence of the great meteoric shower on the night of the 27th of November, 1872, I published a theory of the cause of these phenomena, and stated that on the 8th of September, 1879, the astronomical event to

which I attributed them would occur within eight hours and twenty minutes of the time it did in 1833, which was followed by the memorable meteoric shower of November 13, in that year. Should the brilliant shower be repeated on the morning of the 13th of November next, it must be accepted as a verification of the theory.

At the same time I pointed out that another, a similar astronomical event, would occur on the 9th of November, 1879, which would cause meteors on the 7th and 8th of December following. The meteoric display of December is never so brilliant as those of November. They at times appear as early as December 6, and at others continue as late as December 10.

The expected meteoric shower of the 13th of November next is noted in my almanac of the current year in the forecasts of the weather. It can not appear until after 1 o'clock a. m., when the constellation Leo rises toward which the earth on her orbit is then flying. It is to be hoped that the sky may be clear, that a good view of the spectacle may be had.

The brilliant meteoric shower that occurs on the 13th of November is repeatedly recorded in ancient and modern history, especially by the Arabs, who lived under a less cloudy sky in Arabia, Egypt, Morocco and Spain than the people of Northern Europe do. These showers inspired awe, amazement, fear and consternation wherever witnessed, because the people believed them ominous of an impending calamity.

The brilliant shower that occurred on the night of the 27th of November, 1872, was not observed in the United States, because on that night the Continent generally was covered by a cloud, and where the sky was not cloudy the signal officers report it either as smoky or hazy. It was, however, generally observed in Europe, where the sky was clear, and on board of ships on the Atlantic, and from Greenland to Brazil.

ASTRONOMY.

THE RUSSIAN ASTRONOMER, M. OTTO STRUVE.

PROF. ORMOND STONE.

M. Otto Struve, the Director of the Imperial Observatory of Russia, is now a man sixty years of age, and his whole life, as one may say, has been passed in the midst of astronomical labors. His father was the Director of the Imperial Observatory, then located at Dorpat. It was there that the present Director was born, on May 7, 1819. The elder Struve distinguished himself at Dorpat by his indefatigable labors in the discovery of double stars. In the year 1839 Otto became Assistant at the Poulkova Observatory, upon the removal of his father to that place, and in 1862, his father having become disabled by reason of age, he

was promoted to the full control of the observatory. In 1864, upon the death of his father, he was appointed Director.

In addition to his labors as an astronomer, he has devoted much time to geodesy. As a member of the general staff he has had charge of the surveys which have been made of recent years throughout Russia. In 1845 he published a catalogue of 500 double stars which he had discovered. The "Mensuræ Micrometricæ" of the elder Struve contained the results of a survey of all the northern heavens. The work of the present Director has been supplementary to this general survey. Recently he published a work, the result of forty years' labor, which contains about 10,000 observations. While carrying on the work of looking for double stars, he has given special attention to the observing of binary stars—that is, of those double stars which are found to have an orbital motion. Among his other publications are papers on the satellites of the planet Uranus, determinations of parallax, on the nebulæ, especially those in the constellation Orion, and a new determination of the constant of precession. M. Struve was the first astronomer to compute directly the motion of the solar system in space.

In an interesting paper included among the publications of the Smithsonian Institution for 1867, Cleveland Abbe, formerly Director of the Observatory of Cincinnati, has given an entertaining description of the Imperial Observatory of Russia and its surroundings at Poulkova. Directly south of St. Petersburg, along the line of the great military road from the capital to Warsaw, the wide plain which stretches away from the mouth of the river Neva is broken by a hill of moderate elevation. Both Peter the Great and Catherine the Empress appropriated this spot as a pleasure garden. The road to Warsaw half encircles the hill. On the northeastern slope is situated a small village of the peasantry which has given a name both to the mountain and to the observatory. "On the northeastern outskirts of the village," writes Mr. Abbe, "and not a mile distant from the observatory, we find a favorable spot whence we behold at once the full beauty of the observatory hill. Looking to the southwest we see at first only the log houses and fruit gardens of the villagers, while beyond a wild forest covers the mountain. But a more careful scrutiny converts the forest into a semi-artificial grove, 'The Little Switzerland' of the Poulkovites, covering the abrupt northern slope of the declivity. The curving and ascending Warsaw road bounds our diminutive forest on the side nearer to us. On the roadside, nestling among the green trees of the observatory park, is a white arched porch, covering a far-famed spring. A little further up, and to the left, is the dwelling of the former observatory mechanician, while very far behind it one sees the tall geodetic signal. Behind the grove peeps out the tasteful little observatory of the officers of the military academy. Thence the green lawn spreads out in front of the imperial observatory, whose three turreted domes crown the hill. These three domes, even from a great distance, are noticeable features in the landscape. Let us leave St. Petersburg by the broad Tsarkoe-Selo avenue, and long before entering the Warsaw road, even before passing under the triumphal arch, if we look directly south we may see be-

tween its pillars the long, straight road, the Poulkova hill, and the domes ten miles distant. The middle and largest dome appears connected with the macadamized road by a narrow line, but our swift troika soon brings us near enough to perceive that the line is a footpath leading straight up the hill, dividing the green forest of our little Switzerland into equal portions on the right and on the left. Only the monotony of the surrounding plains can justify our comparison with Alpine scenery, as we readily acknowledge when, having ascended to the topmost step of the footpath, we learn that the village behind is scarcely one hundred feet below us. Behind us is the long road with its double row of lindens, and St. Petersburg in the distance; before us is a grassy lawn of ten acres, and beyond that the observatory. Our path leads without turning, straight through an avenue of lindens and between fragrant flower beds up to the doric columns of the vestibule. A shaded path on the left takes us behind ancient elms to the observatory of the military academy. One to the right brings us through a grove of changing evergreens to the Peter's stone and the tall signal.

"The Russian architects well understand the use of colors in relieving the monotony of a wintry, snow-covered landscape. We have before us on either hand the deep-red brick dwellings flanked by evergreens and birches and inclosing the observatory, whose brown woodwork and cream colored stucco, resting upon light sandstone foundations, contrast as beautifully with January's snows as with the fresh green of June. One should visit Peter's stone and the quiet graveyard, and linger in this beautiful park before entering the observatory. Under the noble elms the peasants spend many a summer holiday; here travelers stop to rest and lunch, and enjoy the view, and of a pleasant afternoon the observatory families may be seen dining and chatting over coffee or tea, all enjoying the luxury of that open air life that Europeans, and especially the Germans, indulge in so heartily."

The object of M. Struve's visit to this country, as previously stated, was to find out whether the gigantic telescope, which it is proposed to erect at Poulkova, could better be constructed in the United States than in Europe. He examined the observatories at Washington and Cambridge, and afterward visited the manufactory of Alvan Clark & Sons. Afterward he was present at some of the sessions of the American Association for the Advancement of Science at Saratoga, and from the remarks which he made there it may be fairly inferred that he has decided to have the great telescope built in this country. Upon leaving Saratoga he visited Niagara Falls. After visiting Cincinnati he returned at once to New York, and sailed September 10th for Europe. He was accompanied by his son, Hermann Struve.

THE CINCINNATI OBSERVATORY.

The Cincinnati Observatory had its origin in a course of astronomical lectures delivered by Professor O. M. Mitchel, in the spring of 1842, at the hall of the Cincinnati College. At the close of this series Prof. Mitchel presented a plan for

procuring funds with which to found an astronomical observatory, and this plan was carried into immediate execution. A refracting telescope was purchased in Munich, of the German instrument makers Merz & Mahler, at a total cost of nearly $10,000. Four acres of land, occupying a commanding position east of the city, was presented by a wealthy citizen, Mr. Nicholas Longworth. On the 9th of November, 1843, the corner-stone of the observatory was laid, with appropriate ceremonies, by the venerable John Quincy Adams, and in the spring of 1845 the telescope of eleven inches aperture was mounted upon its pier. No sooner had the observatory been completed than a fire destroyed the Cincinnati College, and as no financial means had been provided for the maintenance of the observatory, Prof. Mitchel was compelled to resort to the delivery of popular lectures in order to gain a support. Although these duties left him but little time for scientific investigation, he struggled bravely on, until, in 1859, he removed to Albany to assume control of the Dudley Observatory. Two years later, upon the breaking out of the rebellion, he entered the military service, and after a short but brilliant career lost his life as the result of exposure to the hardships of the field. The value of Prof. Mitchel's work cannot be overestimated. Besides his observations and the invention of the chronograph, he accomplished a valuable work in arousing public interest in astronomy by his lectures, which were marked by great clearness of thought, vividness of imagination and beauty of diction.

For the next few years after Mitchel's death the institution remained practically dormant, until, in 1869, Prof. Cleveland Abbe assumed charge, his salary having been guaranteed by a number of the liberal citizens of Cincinnati. A comprehensive plan of observations was immediately inaugurated. The smoke from the city, which had now grown until it quite surrounded the observatory, interfered very materially with Prof. Abbe's labors, and he was compelled to devote a large portion of his time to meteorology. In fact, his administration is rendered memorable by the services of daily weather reports which he inaugurated, from which afterward sprung the system now employed by the United States Signal Service, and by his efforts looking toward the permanent establishment of the observatory in a more eligible location. As a result of these efforts, an agreement was entered into in 1870 between Mr. Longworth's heirs, the Astronomical Society and the city, by which the sale of the old site was permitted and the city pledged to maintain the Observatory in connection with the University. As a part of this plan, Mr. John Kilgour donated $10,000 for building purposes and a magnificent site of four acres of land at Mount Lookout, about six miles east of the city. The observatory was completed in 1874, and in the spring of the following year Prof. Ormond Stone, of the Naval Observatory at Washington, was elected Director, and entered at once upon the duties of his office.

The position now occupied is probably more suitable for astronomical purposes than any other which could have been obtained in Hamilton County. It is free from the smoke and heated air of the city, and the horizon is unobstructed in every direction. The building is 71 feet by 48 feet, with 47 feet elevation. It is

built of brick, trimmed with freestone, and consists of a central portion surmounted by a revolving turret dome and flanked by two wings, one for a meridian instrument and the other for a library and director's room. The principal instrument is the eleven-inch equatorial, originally mounted in 1845 at the old observatory on Mount Adams. It is mounted in the turret upon an iron pedestal which rests upon a solid brick pier. Its object glass has been refigured by Alvan Clark & Sons, and a new driving clock added. The library contains nearly 2,000 volumes, almost wholly collected by the present director. Besides the equatorial and the library, the observatory possesses a valuable collection of subsidiary instruments, including a four-inch Clark refractor, a three-inch Buff & Berger transit, chronograph, clocks, telegraphic apparatus, etc.

The obligations of the city have been promptly met, and in order to secure the income necessary to carry out these obligations, the Legislature of Ohio has directed the School Board of Cincinnati to levy a tax each year upon the city of not less than three nor more than five hundredths of a mill. This levy now yields something over $5,000 per annum, an income by no means large; but still if it is faithfully and economically employed, and the results obtained promptly published, there is reason to believe that an enviable position may be maintained among the scientific institutions of the country. A new era of activity has been entered upon and much has already been accomplished. The latitude and longitude of the observatory have been carefully determined. Transit observations are continually made for the regulation of the standard time of Cincinnati. For this purpose telegraphic signals are transmitted to the municipal departments, and a ball is dropped from a staff at the observatory each day at noon. Much attention is necessarily paid to a great variety of miscellaneous observations and investigations, but observations of double stars form the chief work of the institution. Of these more than 3,000 measures have already been made, and about 150 new ones discovered. Only one assistant, Mr. H. A. Howe, is employed.—*Daily Graphic.*

GEOGRAPHY.

THE PROPOSED ENGLISH BALLOON ARCTIC EXPEDITION.

Next May, the *Army and Navy Gazette* says, is named as the probable time of departure of Commander Cheyne's new Arctic expedition for the discovery of the North Pole. By the exertions af Commander Cheyne, a London Arctic Committee has been established at the head of forty-nine provincial committees. The expedition will co-operate with those sent out by Sweden, Holland, America, Austria and Denmark. The following letter has been sent by Lord Derby to Commander Cheyne:

"DEAR SIR: Having heard your scheme of a new Arctic expedition fully explained in our conversation to-day, I have the pleasure of promising a contribution of £100 in aid of it should you succeed, as I hope you may, in obtaining support to justify you in going on with it. I remain faithfully yours, DERBY."

On Arctic ballooning Commander Cheyne says:

"It having been suggested to me that the collapse of the Paris captive balloon might bear unfavorably upon the project for ballooning in the Arctic regions, as regarded by the public, I beg at once to state that no such accident could occur to balloons while exploring *en route* to the North Pole, for the simple reason that the three Arctic balloons would be free and quietly float with the wind, whereas the Paris balloon was captive and was disabled in consequence of a violent squall of wind against which I had to contend, somewhat resembling a ship being knocked to pieces on a lee shore, instead of being safe under snug canvas in mid-ocean. Again, the three Arctic balloons will only be about forty hours from the ship to the North Pole and about the same time on return; yet the Paris balloon has stood its work well for fifteen months.

"I am, sir, your obedient servant, JOHN P. CHEYNE.

"Commander Royal Navy, Proposed Commander of the New Arctic Expedition, No. 1 Westgate Terrace, West Brompton, August 18."

THE "HERALD" ARCTIC EXPEDITION.

The Jeannette, which left San Francisco July 8th, reached Oonalaska, in the Aleutian Islands, August 2d, having made a slow but satisfactory passage to that point. After taking on some supplies of food and clothing, previously collected there for this purpose, she started north with every prospect of a clear passage through the Straits, as the season has been an unusually open one in that latitude.

THE FRANKLIN SEARCH EXPEDITION.

This expedition, which sailed from New York on the 19th of June, 1878, went into winter quarters on the 9th of August of the same year, on the northern shore of Hudson's Bay, in about latitude 64° N. and longitude 90° W. The information in reference to the missing records of Sir John Franklin, which formed the basis of the search, has been found very unreliable, as will be seen by the following extract from the report of a member of the expedition:

"Since landing from the Eothen at that camp, every effort has been made to trace to its foundation the story upon which the expedition was based, and so far we have succeeded in ascertaining that there was no truth in it. Before leaving New York we were led to believe that there were residing with the Iwillich Esquimaux two Natchilli natives, one of whom had given a spoon to Captain

Barry; that subsequently, while writing in his log book, he overheard these two men remark that in the cairn from which they had taken the spoon were articles similar in character to the log, and as the spoon had been identified as belonging to one of the officers of Sir John Franklin's party, the presumption was most natural that the articles referred to were indeed the long lost records of that ill-fated expedition. This was indeed sufficiently direct testimony to warrant a vigorous search, and when, as was stated, they offered to conduct Captain Barry directly to that cairn, the labor of a search party seemed to be reduced simply to that of a journey over a difficult route to a goal that was well known to its guides. But it appears now that Captain Barry got the spoon while on Depot Island, after having been shipwrecked on the whaler A. Houghton in 1877, and that any conversation that was had about cairns was while on a previous voyage and at Repulse Bay. Furthermore, it is quite evident to any one who has been much with the natives of this region that neither Captain Barry nor any other white man would be able to understand them while conversing with each other, although he might be able to make them understand him if he desired to talk to them."

It is to be regretted that the learned President of the American Geographical Society permitted himself to be so widely misled by the story of the whaler Barry, opposed, as it was, to the actual knowledge of others—among them Dr. John Rae—familiar with the localities referred to in his statement. Although it seems probable that the expedition will be unsuccessful in accomplishing the main object for which it was fitted out, there is reason to hope that the labors of the scientific members of the party will be productive of good results.

NORDENSKJOLD'S EXPEDITION.

The Swedish exploring steamer Vega, belonging to the Nordensjöld expedition, arrived at Yokohama September 2d, having successfully accomplished the Northeast Passage. The expedition sailed from Gothenburg on July 4, 1878, and a four days' sail brought it to Tromsöe (a Norwegian port on an island of the same name), where the outfit of furs and necessaries for the high latitudes was completed. Here the Vega was joined by the companion steamer, the Lena. On July 25th both vessels sailed from Tromsöe, passed through the Yugor Strait (south of Nova Zembla) on August 5th. There was not a particle of ice to be seen between Waigatsch (Vaigatz, a Russian island) and the continent. The Kara Sea, hitherto dreaded by all sailors in the Arctic regions, was equally free from ice, and anchor was cast at Port Dickson, near the mouth of the Yenessi, on August 6th.

After a three day's delay there the two steamers steered northeast toward the dreaded Taimur land and the North Cape. The ice arrested their passage and they were compelled to remain at Tajoyr (Cape Taimur?) four days. On August 19th, Tsejdekin, the extreme northern point of Asia, was reached, where a short

rest was taken. The Vega coasted the peninsula, very little ice being encountered, and anchored at the mouth of the Lena river on August 26th. To the northeastward were the islands of New Siberia, which were soon sighted, but were not explored because of the great fields of ice that girt their shores. The mouth of the Kolwya river (latitude 69° 30′, longitude 161° 30′), a broad estuary, was found open. The difficulties soon began, however, and increased daily. They were delayed much by the ice between Cape Cook and Van Karema. They crossed Kolintsehm Bay on September 27th with comparative ease, but were imprisoned on the 28th near a Tchuktchi settlement (latitude 67° 7′ N., longitude 177° 24′ W.)

The vessels wintered in the pack ice at this point, one mile from land. The entire ship's company maintained the best of health and spirits. Not a single case of scurvy occurred on board. During the shortest day the sun was above the horizon less than three hours, and then only the upper limb was visible. At this point much time was devoted to interesting scientific and ethnographic studies. There were 4,000 inhabitants in the several villages near by, who subsisted by fishing and sealing. They are called the Tchuktchi, and are a very agreeable class of people for an exploring party to meet. They supplied the expedition with bear and reindeer meat. The cold was intense, averaging 36° centigrade (32.2° below Fahrenheit). The game was abundant in the spring, wild fowl being taken in large numbers. They were detained in the ice at this point 264 days, but were released on July 18th, 1879, and passed East Cape into Behring Sraits on the 20th.

The Professor says:

"I fully accomplished the object for which the expedition was sent out by Dr. Dickson—namely, a practical proof of the existence of a Northeast Passage. Then the Asiatic coast was followed and St. Lawrence Bay was crossed to Port Clarence, Alaska. Thence we crossed to Koniyan, dredging carefully in order to determine the formation of the bottom of the sea, many specimens of the fauna and flora being obtained. The location, breadth, velocity and approximate volume of the Arctic and Pacific Polar currents were charted and calculated. Having touched at St. Lawrence Island, we next proceeded to Behring Island, where we received the first news from Europe through the resident agent of the Alaska Trading Company. The fossil remains on Behring Island are of immense variety. A new marine animal was here discovered, which we named *Rhytina stellari*. The Vega left the island on August 19th, and had a pleasant voyage until August 31st, when a severe gale was encountered, accompanied with lightning. During the storm, the lightning struck and shivered the main-top-mast, slightly injuring several men. We arrived off Yokohama at half-past eight on the evening of September 2d. All are well and no deaths have occurred during the voyage.

"The Vega is the first vessel to make the passage, and I think the voyage from Europe to Asia by Behring Strait is certain and safe, with very little more experience of navigation in the Northern seas. From Japan to the mouth of the

Lena river there are no difficulties in the proper season, for experienced sailors. The Lena river taps Central Siberia, and a large prospective trade can readily be developed."

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

THE MECHANISM OF THOUGHT—PLANETS YET TO BE DISCOVERED—ORIGIN OF COAL AND RAIN.

PARIS, August 1, 1879.

Mind has been compared to a store-house of images mutually dependent on each other. These images are produced by sensations, then grouped and lodged in cerebral cells. Suppose we have witnessed some emotional spectacle—a surgical operation, for example. We saw it yesterday, and can recall it to-day in its fullest reality. The mechanism of thought is thus constituted by the sensation of a sensual organ, sight, the perception of this sensation by nervous centers and its fixation in the state of image, and the power to recall this image. Sight has furnished the illustration, but hearing, tasting, smelling, and feeling could do the same. The resurrection of the image complete and precise, is sanity. When the image is no longer taken for what it is, that is, the souvenir of an impression, but for the impression itself, this state is called hallucination. The mind has not cognizance of the illusion or phantom; it believes to have taken what it wants from a different brain cell. Nightmare is an example of this illusion, but which is dissipated at the slightest material event, the touch of the bedclothes, or another mental image, recalling reality. Such is the condition of a healthy brain, but in the case of a diseased one, the hallucination dominates so much the region of the brain as to prevent the production of new or sane pictures. The lunatic cannot see the veil which separates reality any more than a bird the obstacle when pecking at a pane of glass to reach a plant on the other side.

I have stated that thought consists of three phases—the perception of the senation, its fixation and conversion into a picture, and the power to recall thaimage unconsciously stored in the brain. Now these three processes are produced by three different nervous functions, so that psychology and physiolology are at last united after being for centuries foes.

The first operation of sensation takes place in the spinal marrow and in the intermediary parts between the two hemispheres of the brain. Deprive an animal of its brain, then pinch the paw; it will retire the latter with a cry. But this is not an exclamation of conscient pain; it is automatic—as mechanical as a parrot's

"How do you do?" The brain has no more to do with the act than it has when we sneeze or cough. It is only when the sensation has been stored up that it can be reproduced as a souvenir; and the more the coats of the brain are extensive and developed, the sharper and more powerful will be the memory. When accident or general paralysis alters or diminishes these coats, thought be comes characteristically slow.

M. Munk, a distinguished German, has just demonstrated, by vivisections, that it is in the gray substance of the lobes of the brain that sensations lodge; that each special sensation has a special center, and that if a part of this gray matter be removed the animal will become mentally blind. The sight of a whip that formerly would make it run and hide in a corner, leaves it now quite indifferent. It remains insensible to ordinary signs. If a dog, it will no longer stand on its hind legs when ordered, or give the paw when demanded. If hungry or thirsty, it knows no more where to find its food, but when found it recognizes food and drink as old acquaintances, and tries to remake its education. The animal resembles a person, blind from birth, that an operation restores to sight and suddenly places in an unknown world. If the paw of a healthy dog is pinched, it will not only cry, but attempt to bite to defend itself. In the case of the dog previously alluded to, no attempt is made at defense. It can perform no conscient act, being deprived of the cerebral seat of comprehension. Similarly, when the coats of the brain are inflamed, a person, after making sundry oscillations to shake you by the hand, finishes by seizing his own nose.

It was formerly believed that the whole of the brain was employed in the same functions. M. Broca, in 1864, demonstrated a center specially reserved to language, in the left cerebral lobe, and in the region of the forehead. When this special point was injured language became suppressed. Hitzig, in 1870, placed the matter beyond doubt, for, in exciting the cerebral envelope by an electric current in the same place, he invariably produced corresponding muscular contractions of the face.

M Munk also shows that, while the whole brain matter is capable of performing the same functions, each function tends to occupy a distinct place in the mass of gray matter. There are thus certain motive-nerves for carrying the thoughts, so as to be converted into movement, and these nerves, or routes, when destroyed are capable of being re-made, or new ones created.

The idea-nerves are totally distinct from the carrying ones. Cut off the head of a frog; it will swim till it dies, because it is an automatic or muscular fact. In an aged subject, it will perform movements of an habitual nature. Cut off the head of a pigeon; it will place the stump of the neck under its wing. A young pigeon will never do so; hence the force of habit. Brosses wrote, in 1765, that the germs of speech, or the inflections of the human voice, are necessarily physical effects, and the first syllables a child pronounces are labials, because the lips, accustomed to sucking, are the parts the most agile. As the child advances in age, the efforts of memory are markedly automatic. A school boy, by repeating

aloud his lesson, can, when he falters, recall the following words by the mere sound of their predecessors—a purely mechanical operation. Habit, "that violent and treacherous school-mistress," as Montague wrote, is not our second, but our first nature. What are our most predominating ideas? Those of our youth, for the first images were easily engraved in the memory. They found the storehouse, the brain, unoccupied, and, as first arrivals, helped themselves to the best places. Later ideas had to go up higher and occupy less favorable cells. It is thus that when senility sets in they are the images, the souvenirs of youth, that are the most dearly caress d and that form the last dreams of life.

Such, then, is the present state of the question of the mechanism of thought. Science cannot explain the play of these nervous cells which makes one person virtuous and another criminal. The physiologist has only to deal with perceptible phenomena. Between the physical and the moral world there is still a great gulf fixed.

The world appears to be to-day almost as contented as the ancients, with their orthodox seven planets, and which have given their names to the days of the week. Indeed it was once a heresy to suppose the sky contained any others, and Herschel broke the charm by discovering, in 1781, *Georgium Sidus*, named after his royal benefactor, but which astronominal opinion forced to be changed to Uranus—the oldest of the gods. No other important planet was discovered till 1846, when LeVerrier made known Neptune. Kepler, remembering Plato's observation that God in creating the world must have known geometry, sought for a long time to discover a law regulating the distances between the planets, and which he expressed in a very simple series. Something was wanting in the calculation of those little stars called "telescopic planets." Hitherto they were named Ceres, Juno, Vesta, etc., but becoming so plentiful, they were baptized with a number. In 1874 they were 134; in 1879, 198, and it is estimated that there are 160,000 yet to discover. These stars are very tiny, hardly the size of an ordinary shire. A good pedestrian could make the tour of one of these worlds in twenty-four hours. In point of theory, these *petits* are important. Where do they go, or where have they come from? Olbers concludes they are the fragments of a planet. If so, they ought, after making their revolutions and following a mechanical law, to return to their common point of departure, which they do not—Juno excepted. In Laplace's theory, the solar system at its origin was an immense nebulus, which on cooling detached planets under the form of globules; and Roche has established that these tiny stars need not necessarily take an elliptical form. LeVerrier has calculated that the mass of these telescopic planets is limited, and ought not to exceed one-third the mass of the earth; and Messrs. Seidel and Argelander compute that the dimensions of fifty of the most notable of these little stars do not exceed in their total the ten-thousandth part of the earth's volume At this rate, 160,000, as remarked, may yet be discovered.

XUM

What is the origin of coal and of rain—two important subjects? Coal was supposed to be produced by some clumsy process of pressure—more supposititious than exact. Coal beds are the product of accumulated masses of vegetation, of which bogs represent one of the stages of formation. But no one has ever been able to make coal, even under heat and pressure applied to vegetation, as presumed by MM. Daubrée and Baroullier. M. Frémy tried to do so, but could not transform vegetable organisms into coal. However, he took vegetable products, as sugar, starch, gum, and the green matter of plants, calcined them and obtained something resembling coal. Indeed, on heating the residuum he produced water, gas, tar, and even coke. He concluded that the ultimate product of vegetable decomposition is ulmic acid; that turf in some of its stages contains sixty per cent of this substance, and when heated under pressure and during 200 hours, becomes transformed into a matter identical with coal. The latter, then, is peat, dating from ancient geological epochs, and transformed by fermentation, where the organism of the tissues has disappeared, and the resulting ulmic acid, under the influence of heat and pressure, becomes coal. Respecting the marks of plants in coal, they are produced by a moulding process peculiar to schists and other mineral substances.

Where does the rain come from, or why does it fall so mercilessly in our regions? Scientists afford no positive solution, save to reject the theory of relation between spots on the sun and constant rain. The minimum of spots ought to coincide with dry years. Unfortunately, the contrary has just been the case in Europe. At the equator, the sun evaporates unceasingly the waters of the oceans, converting them into vapor, which latter, when drawn toward the poles by currents, encounters cold, is condensed and, the air being saturated, falls as rain. The sun pumps up water from the ocean. At the tropics the evaporation must be nearly uniform, as the temperature is so, and, consequently, the amount of water in the air that is condensed as rain ought to be about the same. But the inequality of the rainfall is due to the course of the rain currents. Where these are less frequent fine weather will be more general. As the sun approaches the equator, the zone of bad weather follows the planet. Some writers are of the opinion that the moon exercises an influence on the march of atmospheric currents by her *declinaison*, or relative position above or below the equator, which varies between 18 and 29 degrees, while the sun's is constantly 23 degrees. The nearer the moon approaches to the maximum number of degrees, the more the seasons are humid.

Messrs. Martin and Richet conclude that the injection of milk into the veins is generally mortal, and believe that the diuretic action of milk is due to the sugar it contains.

PROCEEDINGS OF SOCIETIES

THE SARATOGA MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY A MEMBER PRESENT.

Why a town so eminently unscientific as Saratoga should have been chosen for the meeting this year of the American Association for the Advancement of Science, is to be explained only upon the supposition that the managers knew more about the welcome we should have there than did we of the commonality, while everybody concluded that he would "have a good time and take his wife." At any rate, a striking feature of the meeting this year was the large number in attendance. And they were all men with a little money in their pockets and a little knowledge of carpet etiquette. The scant-sleaved gawky from some country college, whose forte is mathematics and destination to be distinguished in in-invention; the shy professor from a rural academy, whose specialties are short-sightedness and diffidence; the irresponsible bore who hangs around such meetings in the hope of taking part in some discussion for which he has fitness; the slovenly woman of science who wishes to read an essay—all these were absent from the Saratoga meeting, which is equivalent to saying they have been seen elsewhere. Of course, they would have been welcome and properly valued in the sessions, but either their short purses or their exaggerated appreciation of the brilliant society of the Springs, caused them to stay away.

The laboring oar of the Local Committee was Captain A. R. McNair, of the Navy, whose efforts toward our comfort and indulgence were indefatigable. The usual arrangements were made for reduced rates on the railroads and at several of the hotels. The large hotels were greatly crowded, however, with ordinary guests. When, therefore, the dusty man of science presented himself at the desk of the United States and claimed the room which he had been told had been engaged for him, he was informed that there were no rooms, or at least that he could have none until "to-morrow." However, when some of the wise ones, holding their heads up, registered and called for rooms, saying nothing about the Association, they got them quickly enough, and afterward paid at the reduced rate. At some of the lesser hostelries, like that fine little "Waverly House," we had no such trouble.

It was good fun to see how the "butterflies" around the hotels and in the park regarded the Association. It was a patronizing, pitying sort of an air. They had their jokes, and did not hesitate to do their own laughing. But this finally changed when they found we were not all ourangs. This was partly due to our

wives and daughters, who supported us nobly. As I remarked, these wives and daughters of ours were by no means "frights" and "blue-stockings." They dressed as well (a great deal better so far as taste went), behaved as well, and were just as gay, witty, accomplished and charmingly *neglige* as Saratoga's belles, matrons and misses. The fact that they were wiser was no disparagement. Nevertheless, some funny people came to the meetings now and then, as they always do, but there was a gratifying absence of bores.

The exercises were of a very interesting character, and rather an unusual amount of enthusiasm was manifested. Thirty-six fellows and two hundred and ten new members were elected. The number of old members present was two hundred and fifty-eight, and one hundred and fifty-four papers on various scientific subjects were entered.

Your readers will certainly excuse me for not writing out what has been so well said in the following abstracts, culled from such reliable and able periodicals as *Science News*, *Scientific American*, etc.:

The address of President Barker was the principal feature of the morning session of the first day. In the course of his remarks, the object of the Association was declared to be the advancement of science not only by the discovery of new truth, but also by the diffusion of that already known To this end it extends a cordial recognition to all organizations of whatever sort whose objects are akin to its own. Being itself national in character—for science knows no country and no section of country—it gives its indorsement to all local enterprises, and stands ready to assist them in any legitimate way. Whether it be a State, geological, or topographical survey, an academy of science, or association or individual seeking to unravel nature's secrets, the Association desires to strengthen their bonds and to uphold them in the communities where they are located. Its province is to awaken an interest in pure science; or, where such interest already exists, to develop it to the full. It invites all interested in science to its membership, and opens its sessions to all comers. That its periodical and migratory meetings, in the words of the constitution, have actually done what they intended to do, have promoted intercourse between those who are cultivating science in different parts of America, have given a stronger and more general impulse and a more systematic direction to scientific research, and have procured for the labors of scientific men increased facilities and a wider usefulness, no one who has watched its history can doubt.

Less perfect acceptance, we fancy, will be accorded Mr. Barker's subsequent remarks, in which he excludes inventors from the ranks of original investigators and discoverers. It is true that in many instances the discoverer has not been an inventor, and that discovery has usually been the real mother of invention; true, also, that original research is the storehouse out of which comes invention. But it will not do to assume, as Mr. Barker appears to, that discoveries are made only or generally by men who "patiently investigate truth for its own sake," and "deny" themselves "the good things of this life to obtain it." There is rising up among us a generation of inventors, who are also explorers and discovers of the

most energetic and successful type; and they push the work of investigation and invention with no intention of denying themselves the good things of life. Their inventions pay, but their discoveries are none the less scientific and honorable.

The title of Prof. Marsh's address is "The History and Methods of Palæontology." It is quite certain that no man in this country is more competent than Prof. Marsh to compile and write on this theme. He has for years been collecting a library of works on the subject, and of these many, and perhaps the most important, are in German—a language and literature with which he is familiar. The address is by no means, however, a mere compilation; its author recognizes the far-reaching results to which the rocks and fossils are leading us, and regards them as giving a promising path toward solving the question of questions, "What is life?"

The historical portion of the address divides the progress of Palæontology into four epochs. The first of these begins with the earliest literature and ends at the eighteenth century. During that whole period, the nature of fossils—whether they were freaks of nature or the remains of animal life—was the subject of bitter dispute, and the question remained open. Mostly the theory of the ancients and of the earlier moderns on this subject were fantastic; though in a few instances correct views were advocated. The notion long held sway that fermentation or a plastic force in nature had developed fossil forms. In the second period, reaching from the beginning to near the close of the eighteenth century, the belief prevailed that fossils were deposited by the Mosaic deluge. Prof. Marsh has preserved many entertaining incidents and facts connected with this period, when it was the fashion to regard fossils as belonging to that wicked world which was destroyed by the flood, and huge saurian remains were supposed to be portions of human skeletons belonging to the accursed sons of Anak. The third lasted till about twenty years ago, and was characterized by correct views as to the general nature of fossils, but was embarrassed by a belief that every species, extinct and living, had a separate creation. The last period—the present—is distinguished by the acceptance of the doctrine of evolution. Professor Marsh dates the revolution in belief on this subject from the publication of Darwin's "Origin of Species" in 1859. The characteristics of the present period in Palæontology were stated as "the belief that all life, living and extinct, has been evolved from simple forms," and "the accepted fact of the great antiquity of the human race."

The progress made during the past twenty years in this science is very great. The address enumerated many of the noteworthy additions to the number of extinct species. A more important fact is that the genealogies of various existing mammals have been traced with considerable probability through allied forms in closely-connected series. The evolution of the horse, Professor Marsh asserts, is to-day demonstrated by species now known. "The demonstration in one case stands for all." The active workers of science regard it as "a waste of time to discuss the truth of evolution; the battle on this point has been fought and won." The address concluded with a brief review of the evidence for the antiquity of

man. His existence in the quaternary epoch, it is said, is now generally accepted. Prof. Marsh favors a view expressed on "high authority," estimating the antiquity of man in Europe, judged by the glacial epoch, as 250,000 years. There is also strong evidence of a yet earlier existence in the Pliocene of America.

Justice cannot in a contracted space be done to the address of Prof. Marsh, which teems with apt citations, entertaining lore and shrewd suggestion. It ended in these remarkable words:

"I have endeavored to define clearly the different periods in the history of Palæontology. If I may venture, in conclusion, to characterize the present period in all departments of science, its main feature would be a *belief in universal laws.* The reign of Law, first recognized in the physical world, has now been extended to Life, as well. In return, Life has given to inanimate nature the key to her profounder mysteries—Evolution, which embraces the universe.

What is to be the main characteristic of the next period? No one now can tell. But if we are permitted to continue in imagination the rapidly converging lines of research pursued to-day, they seem to meet at the point where organic and inorganic nature become one. That this point will yet be reached, I cannot doubt."

The annual address on "Solar Physics," before Section A, was delivered by its presiding officer, Professor S. P. Langley, the astronomer of Allegheny Observatory, who is himself specially distinguished by successful researches concerning the light, heat, and physical constitution of the sun. The address was in part historical, and gave full credit in turn to the successive students of the solar surface who have gradually developed a branch of science that is wholly modern.

Prof. Langley described the improved photographs of the sun which he had recently seen at the observatory of M. Jannsen. The original negatives are on a scale of about thirty inches to the solar diameter, and will bear enlargement to nearly ten feet, with remarkable precision. One of these negatives, containing over a million distinct cloud-forms, can be taken in 1-3000th of a second. By such means eye-studies can be wholly superseded, and when sun-spots appear, their birth, extension and disappearance can be better understood. The reproduction of spectral lines by photography, for which so much credit is due to Mr. Rutherfurd, has led recently to more surprising results in the hands of Captain Abney, of the Royal Engineers, South Kensington, who has photographed the red end of the spectrum and far beyond it, to a wave-length of 12,000. That is, we can photograph non-luminous objects, in total darkness, simply by their heat rays. The discovery indicates that we may yet photograph any object that is giving out heat, even though the temperature may not exceed the boiling point of water. M. Cornu has worked at the other end of the spectrum, and extended it beyond the violet ray to a wave-length of 2,900. These extensions of our knowledge of the spectrum have taken place within the past year. Mr. Lockyer has shown reason for belief that many of the so-called elements are really compound bodies, which are incompletely dissociated at the highest temperature we can command, and Dr.

Henry Draper has brought forward evidence, still under discussion, of an element being present in the sun which was not previously detected there. Prof. Langley urged the need of a physical observatory in this country upon some elevated station such as that recently constructed upon Mount Etna.

The Nestor of mathematical science in America, Prof. Benjamin Peirce, of Cambridge, a grand old gentleman with a wealth of iron-gray hair and flowing beard, spoke rapidly and without notes, on "The Meteoric Constitution of the Sidereal Universe, and the Cooling of the Sun." The subject is closely connected with the nebular hypothesis. But it is best, Prof. Peirce thinks, first to see what is the present state of things before we go back to the beginning. Let us see what is going on now. A paper on the physical constitution of the sun, by Sir William Thomson, was referred to by Prof. Peirce with high approval. The further any methematical investigation is made in this class of researches, the more frequently difficulties arise; but the more we make science infinite rather than finite, the more we make it worthy to be studied by an infinite being. In a fine clear evening we see the stars, and, therefore, we believe in them. But when it is clouded you yet believe in them quite as much as before. Similarly, to the geometer, the planets which at times disappear, but yet can be predicted to return, are known to be in their appointed places. There are heavenly bodies—meteors—which we seldom see three minutes at a time, and usually for only a few seconds. Yet we know that these have existence elsewhere before we see them. If these invisible meteors were abstracted from the universe, the fires of the sun and stars would ultimately go out and everything be left in darkness. All matter is but the concatenation of meteors, whether it takes the form of suns, planets, nebulæ, comets, or meteor streams. Small meteoric bodies are naturally cold, and hence invisible. This is probably the natural condition of matter, or at all eveuts of meteors. The ingredients of meteors may be of the most various kind; the carbon contained in those which reach the earth may be burned out.

Prof. Peirce does not believe in the accepted theory that a gas must give a continuous spectrum. He believes that all stellar light is produced by superheated gas, the heat being too great for the possibility that anything but gas can be present. He referred with favor to the theory advanced by Mr. Lane, of Washington, that a gaseous body, giving out heat, must be every moment growing hotter, In the case of the sun, if it were contracted to half its size, the pressure would be sixteen times greater on each cubic foot, and hence the sun would be apt to grow hotter by comparison as it grows older. It is likely to become rather hotter than colder, but probably there will not be much change. Astronomers have adopted the brightness of the stars as a measure of their brilliancy. The elder Struve brought an objection to this, that the small stars do not increase in number as rapidly as they should in proportion to the large ones. Perhaps the presence of dark meteors in celestial space cuts off the light of very distant stars. We must believe that clusters, like those of Hercules, consist of stars that are comparatively near each other. We have no reason for supposing that there are any

stars more distant from us than the smallest stars of the milky-way. The concentration in the plane of the milky-way has been such that all space outside of it is comparatively clear of stars. But the nebulæ are most numerous at right angles, or perpendicular to this plane. They would not be visible, perhaps, if they were in the milky-way, because so distant, as compared with other regions of the sky.

To the ordinary form of the nebular hypothesis Prof. Peirce strongly objects, but he does not wholly oppose it, his views now differing from those he expressed several years ago. The ordinary theory is that a series of rings preceded the formation of the planets, and that these rings broke to pieces and then re-united. He showed that planets formed from such rings would have a retrograde motion instead of the forward motion which they actually have. He believes that the forward motion is a proof that the planets, as well as the sun itself, were produced by the collision and adhesion of meteors. It does not follow that all the meteors were absorbed; there are probably myriads yet outside the solar system.

Major Powell's treatment of Mythologic Philosophy was not only intensely interesting and suggestive, but singularly original, and freighted with a wealth of information with regard to the mental conditions of American savages. No better evidence could be given of Major Powell's fitness for the work he is engaged in under the auspices of the Smithsonion Institution.

Mr. Edison's researches in connection with the behavior of highly heated metals in vacuo are certainly promising. Possibly they mark the opening up a new department in the practical treatment of metals, as well as in scientific metallurgy. Whatever may be the issue of Mr. Edison's efforts in the direction of electric lighting, the results of his investigations are certainly important in furnishing valuable contributions to science.

Professor Leeds, of Stevens Institute, reviewed the long standing problem as to the solubility of ozone in water, and gave the reasons for believing that it is so dissolved, and that it retains in the solution its characteristic oxidizing power.

Prof. H. W. Wiley, of Purdue University, Lafayette, Indiana, described an improved method of collecting and measuring gases soluble in water; and Prof. F. W. Clarke, of Cincinnati, gave a preliminary notice of results obtained in an elaborate revision of the calculations determining the atomic weights of the chemical elements.

The paper of Prof. Goode, of Middletown, Connecticut, on the Menhaden, presented that cousin of the shad as not only the most valuable of the food supplies of edible fishes, but as the most important source of fish oil. Its annual yield of oil exceeds that of the whale (from American fisheries) by 200,000 gallons; and in the commercial value of all of its products it is surpassed by but three fisheries: the cod fishery, estimated in 1876 as yielding $4,826,000; the whale fishery, $2,850,000; the mackerel, $2,275,000. The value of the menhaden taken this year amounted to $1,658,000.

Commander E. P. Lull, U. S. N., read an important and timely paper on

the Inter-oceanic Canal Problem, illustrating by maps and diagrams the several routes surveyed. The character and advantages of the Nicaragua route were specially dwelt upon, and the belief was positively expressed that no commercially practical route without locks had been found.

Prof. Draper's paper on the Identity of the Lines of Oxygen with Bright Solar Lines, as shown in photographs taken with increased dispersion, was read, in his absence, by Prof. Barker.

A very popular and enjoyable paper was Mr. Wm. T. Hornaday's on the Orang-Outangs of Borneo. Touching the possible human relationship of the orangs, Mr. Hornaday said:

"Let such a one (if, indeed, such a one exists to-day), who is prejudiced against Darwinian views, go to the forests of Borneo. Let him there watch from day to day this strangely human form in all its various phases of existence. Let him see it climb, walk, build its nest, eat and drink, and fight like human 'roughs.' Let him see the female suckle her young and carry it astride her hip precisely as do the Cooly women of Hindostan. Let him witness their human-like emotions of affection, satisfaction, pain, and childish rage. Let him see all this, and then he may feel how much more patent has been this lesson than all he has read in pages of abstract ratiocination."

Another interesting paper was on Serpent Myths of the Red Men, by Judge J. G. Henderson, whose paper on superstitions connected with the rabbit, among our Indians and other primitive people, had been listened to the day before.

Mr. Edison's electro-chemical telephone was exhibited and explained by Prof. Barker, Mr. Edison, the inventor, acting also as draughtsman for the blackboard illustrations.

President Barnard, of Columbia College, read a paper on the Past State of the World's Metrology as Bearing on the Progress of Science, in which the progress of modern science was shown to hinge on the possession of exacter means of measurement than the world had previously known.

In this brief notice it is obviously impossible to do anything like justice to the multitude of valuable papers presented to the Association. It has been an active, earnest, business-like session, as notable for its good work as for its full attendance. The place of meeting had been happily chosen, the weather was favorable, and all the external conditions conspired to make the meeting as pleasant as it was profitable.

It was resolved that the next place of meeting be at Boston, Massachusetts, on the last Wednesday of August, 1880.

On behalf of Boston, Professors Rogers, Scudder, Heustis and Putnam returned thanks to the Association for its choice of location.

The officers chosen for the ensuing year were as follows: President, Hon. L. H. Morgan, of Rochester, New York; Vice President of Section A, Prof. Asaph Hall, of Washington, D. C.; Vice President of Section B, Alex. Agassiz, of Cambridge, Massachusetts; Permanent Secretary, Prof. F. W. Putnam, of

Cambridge, Massachusetts; General Secretary, Prof. John K. Rees, of St. Louis, Missouri; Secretary of Section A, Prof. H. B. Nason, of Troy, New York; Secretary of Section B, Prof. C. V. Riley, of Washington, D. C.; Treasurer, Wm. S. Vaux, of Philadelphia, Pa.

THE SHEFFIELD MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The British Association for the Advancement of Science held its forty-ninth annual meeting at Sheffield, the session closing August 28th. The meeting was not as well attended as the one in Dublin last year, still it was quite successful. Many important questions were discussed, of which we give a few selections:

Captain Bedford Pim, R. N., read a paper on the proposed canal across the Isthmus of Panama, which attracted considerable attention. The author first observed that no one disputed the possibility of making such a canal, and it was generally acknowledged that it might be made a paying concern. The choice of a route depended upon the terminal points or harbors, and a still more important feature was the physical geography of the sea in the neighborhood of the ports, for if sailing ships were able freely to enter and depart, the success of the undertaking was secured. At least half of England's 21,000 sailing ships would use the canal, but if nature placed an irresistible barrier to the approach of these ships, a deep shadow would be cast upon the future outlook of the undertaking. He suggested a route parallel to the river San Juan, with a canal of very different dimensions to, and cost of, that at present contemplated. Starting from Monkey Point, now called Pinis Bay, forty miles north of Greytown, he would cut a canal from the inner part of the bay down to the Rama river, a distance of some nine miles. The Rama river itself carried deep water some twenty miles into the interior, and the remaining seventy miles to the lake of Nacaragua would traverse land offering no particular difficulty. From San Miguelito, on Lake Nicaragua, by way of Tipiteta to the northern shores of Lake Nicaragua, there was nothing which an engineer would consider a difficulty, and the remainder of the canal to Port Realejo could scarcely be said to afford any field for engineering skill. In that scheme a deep water canal was not even contemplated. A depth of eight feet would be amply sufficient, the vessels being transported on pontoons, such as had been successfully used in the Victoria Dock for some years. Such a plan would considerably reduce the cost, while other advantages would be gained, such as cleaning the ships' bottoms while on the pontoons, which would effect a saving to owners almost, if not quite, sufficient to pay the canal dues.

The canal would not cost more than ten millions. If England and America would join hands and each guarantee 1½ per cent on that amount, there would be a joint guaranty of 3 per cent, an indication sufficient for English investors alone to take up the sum in less than a week. What was 1½ per cent on ten millions? One hundred and fifty thousand a year, a sum annually wasted on

any vote exceeding one million of the navy estimates. And what did we get for our money? A consolidation of the friendly feeling between this country and the United States, far more lasting and binding than could be effected by any treaty between the two nations merely guaranteeing the neutrality of the route. The representative of the American Government at the Paris Congress left no room for doubt as to the line of canal preferred by his government, and clearly and unmistakably pointed to Nicaragua as the best. He (Captain Pim) trusted the government of Great Britain would not, for the sake of saving the annual part of £150,000 for a few years, find themselves ultimately compelled to purchase an interest in the new highway at any price which might then be demanded. He most earnestly hoped that the day would not be far distant when we should see the completion of this great work of inter-oceanic canalization across Central America. He believed that such an undertaking would give a beneficial stimulus to the commerce of the whole world, and, consequently, could not fail to be a great and common boon to mankind.

M. Bergeron said there were many objections to M. de Lesseps' scheme, and many engineers were opposed to it. He quite agreed with the deductions of Captain Pim.

Captain Galton thought one of the difficulties of M. de Lesseps' canal was how to cut one that size through such a country and in such an unhealthy climate. He asked Captain Pim whether it was necessary in the Nicaraguan system to raise ships my means of pontoons in order to carry them across certain distances. That seemed to him to interpose enormous difficulties in the work of the canal, which to be universally applicable must be simple and effective.

Mr. R. B. Grantham thought the mode of transporting ships through the canal, as proposed, would be a difficult matter, and it was a question whether the pontoons would not be so expensive as to overbalance the expense of a greater depth of canal.

Mr. E. A. Cowper pointed out that a pontoon large enough to transport a laden ship through the canal would necessarily have a great displacement, so that the pontoons would have to be large, and so would the canal.

Captain Pim said that he had only suggested the shallow canal because he feared that it would be impossible to so improve the delta of the San Juan river as to make it a proper harbor. Of course, every one would prefer to sail through the canal rather than to have to be hoisted through on a pontoon. A pontoon with a large ship on it would only draw four feet of water. He had seen laden ships easily raised on a pontoon. His suggestion was merely made on the supposition that the delta of the San Juan could not be improved, but he did not, of course, for a moment presume to say that it was the right one. A deep water canal through the route he had mentioned would cost £30,000,000 sterling, a sum sufficiently large to frighten both Great Britain and America. A shallow canal, such as the one he had suggested, would cost about £10,000,000 sterling. Of course, if the smaller scheme were carried out it could afterward be improved.

Captain Cameron, in the Geographical section, read a paper on the "Euphrates Valley Railway," previously to which he spoke of the Island of Cyprus, which he had visited. He said, in substance:

The island of Cyprus would prove of great advantage to the British Crown. It was of strategical importance, and was also valuable as showing what, under good government, even with Turkish laws, which had been so much abused, properly applied, Asiatic Turkey was capable of. Cyprus was said to be unhealthy. There was a great deal of sickness among the troops, but it must be remembered that they were landed and went into tents at the worst season of the year. Coming to the subject of his paper, he discussed the various proposed routes for a railway to India, and thought the most prominent one was from Tripoli to Aleppo, in the valley of the Tigris, to Bagdad, and thence to Bushire. The local traffic already existing was very considerable, and would almost immediately increase enormously. With Tripoli as the Mediterranean terminus, there would be many and great advantages. There were two good roadsteads, one sheltered from all winds, except from the north and east, and the natural configuration of the land would immensely facilitate the formation of a port. The trade of the port had great capabilities, and might be indefinitely extended, as large tracts of well watered land were lying fallow, owing to want of transport. The line which he should propose for the railway would be along the level country between the sea and the mountains, till, after passing the Nahr-el-Barid and Nahr-el-Kebir, they would reach a fertile plain. After about three miles of difficult work, where some engineering might be required, there would be a gradual ascent to the plains around Homo. Here the Orontes would have to be crossed, but a bridge sixty feet in length, with approaches on either side of about one hundred yards, would be amply sufficient.

He pointed out that while the cost of carriage for goods per mile by means of canal was at least 8d per ton, conveyance by rail would not cost one-third of that amount. Many branches of cultivation might be easily developed if good government could be secured and the capital lying idle in the country, which must be very large, employed. The whole distance between Tripoli and Aleppo was 197 miles, and the distance as the crow flies 165 miles. From Aleppo to Alexandretta was 97 miles farther, in the course of which the Beilan Pass would have to be crossed, at a vast expenditure of time, labor and money. Probably this work would cost as much as the whole of the rest of the line from Tripoli to Aleppo, and would probably occupy eight or nine years. The total length of the line would be 340 miles. Nothing would have such important political and commercial results as this line, than which no line of such length and importance possessed so few physical difficulties to be overcome, and presented so great a prospect of financial success.

At the concluding meeting it was announced that the grants of money appropriated to scientific purposes by the General Committee amounted to £960. The following is a list of the grants: A. Mathematics and Physics—Dr. Lodge,

new form of high insulation key, £10; Prof. Adams, standard of white light, £20; Prof. Everett, underground temperature, £10; Dr. Joule, determination of the mechanical equivalent of heat, £50; Sir W. Thomson, elasticity of wire, £50; Mr. Glaisher, luminous meteors, £30; Mr. G. H. Darwin, lunar disturbance of gravity, £30; Prof. Sylvester, fundamental invariants, £50; Mr. J. Perry, laws of water friction, £30; Mr. W. E. Ayrton, specific inductive capacity of Sprengel vacuum, £20; Rev. Prof. Haughton, completion of tables of sun-heat coefficients, £50; Prof. G. Forbes, instrument for detection of fire-damp in mines, £10; Mr. J. M. Thompson, inductive capacity of crystals and paraffines, £25. B. Chemistry—Dr. Dewar, spectral analysis, £10; Dr. Wallace, development of light from coal gas, £10. C. Geology—Prof. Duncan, R. M., report of carboniferous polyzoa, £10; Prof. A. L. Adam, caves of South Ireland, £10; Prof. Seeley, viviparous nature of ichthyosaurus, £10; Mr. John Evans, Kent's cavern exploration, £50; Mr. John Evans, geological record, £100; Prof. W. C. Williamson, moicene flora of the basalt of North Ireland, £15; Prof. Hull, underground waters of Permian formations, £5. D. Biology—Dr. Pye Smith, elimination of nitrogen by bodily exercise, £50; Mr. Lane Fox, general anthropological notes, £20; Mr. Stainton, record of zoölogical literature, £100; Dr. M. Foster, table at zoölogical station at Naples, £75; Dr. A. Gamgee, investigation of the geology and zoölogy of Mexico, £50; Sir J. Lubbock, excavations at Port Stewart, £15. F. Statistics and Economical Science—Dr. Farr, anthropometry, £50. G. Mechanics—Mr. Bramwell, patent laws, £50. Total, £960.

SCIENTIFIC MISCELLANY.

CHEMICAL COMPOSITION OF MINERAL COAL.

ABRIDGED FROM "COMPTES RENDUS" BY PLINY EARLE CHASE, LL. D.

For nearly thirty years Prof. E. Fremy has been studying vegetable tissues, with especial reference to the chemical nature of the principles which they contain, and the influences which have changed them into lignite, bituminous coal and anthracite. He began with examining the vegetable skeletons. The substances which he first studied were almost wholly unknown; their characteristic property is their production, under the influence of a ferment or of reagents, of gums and gelatines. He showed that they are all derived from a primitive insoluble compound, which he called *pectose*, represented in its greatest simplicity by the formula $C_8H_5O_7$, and which, by successive polymeric transformations, forms at first gummy substances, then gelatinous bodies, and finally an acid soluble in water.

He then began the study of the stable elements which form the fibers, cells

and vessels. He found that the vegetable frame-work is not so simple as he thought; it is not built of simple cellulose, differently incrusted by other substances, but of many kinds of isomeric cellulose. There is also, in nearly all parts of the skeleton, a very important body, which differs from the celluloses in composition and properties, which abounds in the vessels, and which he therefore calls *vasculose*. The proportions in which it exists in different kinds of wood affect their physical qualities. Oak may contain 30 per cent; in walnut-shells there is sometimes 50 per cent. It binds the woody fibers together. Caustic alkalies dissolve it, and they are therefore employed in the manufacture of wood paper.

After ascertaining the composition of the internal tissues, he analyzed the cuticle and other coverings, discovering *cutose*, which is well fitted, by its resistance to chemical change, for protecting the parts which are exposed to the air.

Passing, next, to the bodies which are most often found in the tissues, he showed that gum is a true salt of lime, and that chlorophyll owes its green color to a salt of potash.

In extending his studies to combustible fossils, he first sought what chemical differences characterized wood, peat, the different lignites, bituminous coal and anthracite. He found that wood is not sensibly attacked by a dilute solution of potash, while peat often yields to that alkali considerable quantities of ulmic acid; xyloid lignite, or fossil wood, still contains notable proportions of ulmic acid, but it is easily distinguished from wood and peat, because it is changed into yellow resin by nitric acid and it is completely soluble in hypochlorites; compact or perfect lignite contains no appreciable ulmic acid, and still it is dissolved in nitric acid and the hypochlorites; as to the true coals, they are characterized by their insolubility in neutral solvents, acids, alkalies and hypochlorites.

In his synthesis, he was guided by the experiments of Daubree and Baroullier, which indicated the importance of heat and pressure in coal metamorphosis. He performed a series of experiments, in which vegetable tissues and the substances which most often accompany them in organization, were separately kept, for a considerable time, at temperatures ranging from 200° to 300° (392° to 572° F.), in hermetically sealed glass tubes. He found that cellulose, vasculose and cutose all became black, brittle, yielding water, acids, gas and tar, but preserving their organization; they did not melt, but gave a fixed product which showed no resemblance to mineral coal. With sugar, starch, gum, chlorophyll and the fatty and resinous bodies which accompany it in the leaves, the results were very different. By long calcination under pressure they became black, shining, often melted, absolutely insoluble in the tested chemicals, and very different from charcoal, for when heated to redness they behaved like organic bodies, yielding water, etc., but having, as a fixed residuum, a hard and brilliant coke. The chemical resemblance to a specimen of Blanzy coal, which was analyzed by Renault, is thus shown:

	Carbon.	Hydrogen.	Oxygen.	Ashes.
Coal from sugar	66.84	4.73	28.43	
" " starch	68.48	4.68	26.84	
" " gum arabic	78.78	5.00	16.22	
Blanzy coal	76.48	5.23	16.01	2.28

He was induced to experiment on these three substances because, according to Ad. Brongniart, they must have abounded in the vegetables which produced the coal beds, and because gum often comes from the transformation of tissues, as Trécul has shown.

Further experiments led him to the dominant hypothesis that vegetables are first changed into peat, and that, in that form, the disappearance of the organized tissues is due to a kind of turfy formation, as Van Tieghem suggested. He then operated on three kinds of ulmic acid: 1, acid which he had himself extracted from peat; 2, saccharumic acid, which he obtained from M. P. Thenard; 3, ulmic acid extracted by treating vasculose by alkalies. They were all transformed into substances similar to the foregoing, under the combined influences of heat and pressure, as is shown by the following analysis:

	Carbon.	Hydrogen.	Oxygen.
Coal from peat acid, heated 24 hours . .	67.48	5.84	26.68
Same, heated 72 hours	71.72	5.03	23.25
" " 120 "	76.06	4.99	18.95
Coal from vasculose acid	76.43	5.31	18.26

Finally, he examined the modifications, under heat and pressure, of mixtures of chlorophyll with the fatty and resinous bodies which alcohol extracts from leaves. Although the mixture was at first soluble in alkalies, after 150 hours' treatment it gave a black substance, viscous, insoluble in caustic alkalies, and presenting an evident analogy to natural bitumens.—*Journal of Franklin Institute.*

MINES OF CUSTER COUNTY, COLORADO.

BY J. K. HALLOWELL.

Having had to visit Silver Cliff within the last few days, I took time to look around, and observe what was to be seen in this second Colorado marvel of the past year. It is a pleasant drive of seven miles from Rosita through the foothills, and across the slightly rolling elevations of the Wet Mountain Valley. Viewing it as you approach, it reminds you of a toy village set upon a green carpet, or to make the simile more familiar, a new Kansas railroad town. Some say it is dull now, and perhaps it is to what has been, but let us go back a little in its history which is so recent that it is not much of a task to learn it, or write it. One year ago in July the first prospectors commenced going there, walking there and back from Rosita, and carrying tools between the two places to be sharpened. It is situated in the middle of the valley, two miles from Grape Creek, and having a single elevated cone or mountain, (Round Mountain,) a mile or so north. The find was hornsilver, picked specimens assaying as high as 1400 ounces silver, and one car load gave a mill return of $8000. One year ago now the whole thing could have been bought for $1000, and nine months after the discovery half of the Racine Boy claim sold for $204,000 cash, or equal

to $400,000 for the whole claim. The whole rock runs in silver, (chlorides,) and is a free milling ore. The cliff that this claim is situated upon juts up from the roadside about forty feet, and extends from that almost level. Experts on whose report the last sale was made estimated the whole rock, to breast it out and mill the whole product, without any sorting would give twenty-two ounces silver per ton. The surface of a claim is 300x1500 feet, and forty feet of it is in *sight*. This gives 18,000,000 cubic feet in sight. Allow fifteen cubic feet per ton, which is a big allowance, and we have 1,200,000 tons of twenty-two ounce rock, equivalent to $26,400,000 which can be mined, milled and reduced to bullion at a cost of $5.00 per ton at the outside. Figures won't lie, but that is a tremendous result, and even at a discount of fifty per cent. on the product there is profit enough in sight for even the $10,000,000 stock company that are the present owners. Is it any wonder that a town of 5000 people was built in less than ten months at that spot? A railroad from Cañon City has been surveyed to it, and a contract already let for water-works. Nor is the Racine Boy the only mine, but the Hornsilver, the Plata Verdel and others of less note are claiming attention, to say nothing of Johnny Bull and Domingo and mines three miles north which are a marvel.

The first visit was made to the sampling works of Messrs. Dillingham & Co. which are a model of neatness and simplicity. Their business does not require any very large plant, merely a crusher and rolls, with the necessary steam power. But it does require accuracy, care and honesty, and this reputation Messrs. Dillingham & Co. have in the highest degree. The ore is sampled when received, and paid for, the same as a wagon load of grain would be after weighing. After which it is crushed, by their machinery, all mixed together and shipped to Omaha and St. Louis smelting and refining companies.

Returning from their works to dinner, we paused a few minutes near a busy scene, namely where the excavation was being made for the foundation of the 40-stamp mill of the Racine Boy Mine. Some sixty to seventy men are at work in the excavation, and on the timbers surrounding the same, giving every promise that the new company mean business, and that in less than sixty days time, the machinery now on the way will be pounding away night and day, and turning an estimated quantity of seventy tons of hard rock into an impalpable mud.

Before reaching the hotel we took a turn over and into (partially) the Racine Boy claim; but a very few men are at work there now, waiting until their mill is ready, I presume. It is impossible to liken this formation to anything known, as it is not down in the books. No regular formation of ore-pipe, chimney or fissure vein appears, but an immense body of silica paste with the chlorides disseminated throughout the mass, and which in solidifying has no regular form of either crystallization or stratification, but has assumed all manner of curves and knots in its change from a fluid mass of wet paste, to its present solid form.

After a hearty dinner at the Powell House, we felt fortified for the three-mile tramp to the Granite formation north of Silver Cliff, wherein the Johnny Bull and Domingo mines are situated. These famous claims are on the one ore-body; much has been said about them, some shooting been done and an apparently interminable law-suit begun. This latter has fortunately been settled by a shrewd speculator getting both parties to name their price, and bonding the titles of all parties at the rate of a quarter of a million for the whole. On the way there we walked over several dikes of obsidian, and by the way there is natural glass enough there to supply all of the glass factories in the United States, if it can only be utilized. The change from the trachyte and porphyry to the granite is strongly marked, and so far, these mines are the only ones found containing pay ore, in the Granite-belt in Custer county. Obtaining permission to examine, we descended to a large excavation from which the ore had been extracted to a depth of forty to forty-five feet, sixteen feet wide and thirty feet long, the wall rock only appearing on one side, and composed of syenite. With that exception, above us, in front, on our right, behind, and under us was mineral, argentiferous galena, bright and sparkling, and lots of it. Taking a lighted candle and passing into one of the drifts, what a sight appears! From millions upon millions of crystallized facets the glimmer of our single tallow dip was reflected, until—well, in an old book wherein we all have read the story and thought it was a fable, and marveled at the richness of the imagination of the original narrator, is the description, but to what reader did it ever occur that Aladdin's cave was located in Custer county, Colorado, a natural and real fact in argent.

The mineral surrounds the syenitic boulders the same as in the Maine mine chimney at Rosita, but here it represents inches where there it represents lines. Two men here can sort as much ore as twenty-five there. A capping of ten to fifteen feet covers the ore on the surface, which is now being removed, and when done a body will be open for work of 30x60 feet surface, and now to a depth of thirty feet in the ore. If we were correctly informed as to mill-returns, there is $100,000 more in sight than the bond calls for, and how much below none can compute. Just try to imagine a cubical mass 30x60x30 feet, of which twenty-five per cent. of the bulk, and fifty per cent. at least of the weight was actual, solid mineral. After viewing this wonder of wonderful mines, we did not want to see any more prospects, but came straight back to the hotel, and it was a theme of conversation and authenticated computation, for my comrade and myself till long into the night. I dream of it yet by night, and in the day-time wonder where is the spot to dig for its like.

Now for a pertinent physical fact in geology, which probablay indicates what is below us here, and may be an index for future explorations: the Johnny Bull-Domingo mine, and the Maine or Bassick mine are both the largest chimneys containing as rich ore as is known in the world. The first is just about as far within the granite, as the latter is within the trachyte, on the same contact line, nearly east and west, and within seven miles of each other. Another fact to gen-

eralize from: nowhere on the face of the globe is there yet known such a rich mineral spot as a radius of ten miles from Rosita now shows. Within that distance we have every formation containing the precious metals known, viz.: chimneys, ore-pipes, fissure veins, rock deposits with minerals, and what might be placers. All of these show rich ore at or near the surface. From these facts, and the knowledge that nowhere have we penetrated to a greater depth on mineral than 250 feet, can any other deduction be drawn than that at some depth, and not more than 1000 to 1500 feet, we have immense and inexhaustible bonanzas yet to be opened and drawn upon for the world's uses. To my mind it is only a question of time and not long either, for Custer county, to become the first mineral producing county in the State instead of standing where she did last year, which if I remember aright was fifth.

GLASS FOR RAILROAD SLEEPERS.

Engineering, in a recent issue, gives the following details on railway sleepers made of glass toughened according to the De la Bastie process, which Mr. Frederick Siemens, of Dresden, a well known German manufacturer, and brother of Dr. William Siemens, is now introducing in England. Some of them have been laid on the line of the North Metropolitan Tramways at High street, Stratford. The sleepers in this case are of exactly the same section as the wooden longitudinal sleepers they have replaced, namely, rectangular, 4 inches wide by 6 inches deep, the upper side being molded so as to accurately fit the rails. They are laid in lengths of 3 feet, and to avoid the danger of settlement at the joints, beating plates 10 inches by 5 inches by 1½ are placed at these points, these plates being also utilized for effecting the securing of the rails by a fastening which obviates the necessity of molding any holes in the glass. The samples of the sleepers above mentioned have been tested by Mr. Kircaldy, and their average breaking weight, when resting on supports 30 inches apart, has been found to be about five tons, this being probably about two-thirds of the resistance which would be afforded by a good pine sleeper of similar dimensions. It must, however, be borne in mind that whereas the timber would become depreciated by use, the glass promises to be practically indestructible by moisture, etc.

At the works of Mr. William Henderson, a plate of Mr. Siemens' toughened glass 9 inches square by 1⅛ inch thick, imbedded in gravel ballast 9 inches deep, and having on its top a wood packing ⅛ inch thick and a piece of rail, was subjected to the action of a falling weight, the blows being delivered on the rail. The weight was 9 cwts., and blows were successively delivered by letting this weight fall from heights of 3 feet, 5 feet 6 inches, 7 feet, 10 feet, 12 feet 6 inches, 15 feet, 17 feet 6 inches and 20 feet. Under the last mentioned blow the rail broke, the glass, however, being uninjured. As a higher fall could not be obtained and a greater weight was not available, a smaller section of rail was sub-

stituted for that previously employed, and the glass was broken by a second blow of the 9 cwts. falling 20 feet, the plate being driven through the ballast into the hard ground. A cast iron plate 9 inches square and ½ inches thick, tested in a similar way, broke with a blow from the 9 cwts. weight dropped 10 feet.

The cost of the toughened glass is stated to be about the same per ton as that of cast iron, but as its specific gravity is only about one-third that of iron, the cost of any article of given dimensions, is, of course, materially less. The material has as yet been too recently introduced, and too little is known of its characteristics to enable any very decided opinion to be formed as to its future capabilities; but the results of the experiments so far made with the material are certainly of an exceedingly promising character, and the further development of its applications will be watched with much interest.

BOOK NOTICES.

COAL FLORA OF PENNSYLVANIA AND OF THE CARBONIFEROUS FORMATION THROUGHOUT THE UNITED STATES. By Leo Lesquereux. Large octavo; atlas of 87 double plates and text in separate volumes. Published by the Board of Commissioners of the Second Geological Survey of Pennsylvania.

This is one of the most valuable reports issued by any of our State geological surveys, and reflects honor alike on the author, the State of Pennsylvania, and American science. The plates are finely executed, illustrating 398 species of plants (about 1,200 figures), of which nearly two-thirds are now for the first time described as new species. These illustrations are largely from the Carboniferous deposits of Pennsylvania, but when peculiar species from other parts of the United States supply some forms not found in that State, they are here described and illustrated. The work thus becomes what its name implies, the Coal Flora, including, in text at least, a full description of all the types of the luxuriant vegetation of that important geological age. Notwithstanding the large number of plates and figures, nearly one-half of the new species are described without them, though illustrations are very necessary for a full understanding of the specific traits. We hope, therefore, that Pennsylvania will authorize the publication of another volume of plates.

This work, with Prof. Lesquereux's Tertiary Flora (1878) and Cretaceous Flora (1874), together with his numerous other smaller publications and contributions to various State geological reports, have now given us a history of fossil botany in nearly all its stages. B. F. M.

LABORATORY TEACHING. By Charles Loudon Bloxam. Fourth edition. 261 pages. Illustrated. Philadelphia, Lindsay & Blakiston. For sale by M. H. Dickinson. $2.00.

This work is for use in the chemical laboratory by those who are commenc-

ing the study of practical chemistry, not pre-supposing any knowledge of chemistry by the student, and not indulging in any theoretical speculations.

As long ago as 1853 Prof. Bloxam, then the first assistant in the Royal College of Chemistry, London, published a Hand-book of Chemistry, which met with the approbation of the distinguished chemists of the day, and also met with decided success. Since then he has succeeded to the chair of chemistry in King's College, and has written several works on the same subject.

This volume is in its fourth edition, and has received all the alterations required in nomenclature, formulæ, etc., to bring it up to the standard of present teachings. In other respects it is practically unchanged from the first edition. Among its excellences we may point out, first a series of simple tables for the analysis of unknown substances of all kinds except organic bodies. Second, a brief description of all the practically important single substances likely to be met with in ordinary analysis. Third, simple directions and illustrations in chemical manipulation. Fourth, a system of tables for blow-pipe work. Fifth, instructions for the purchase and preparation of tests.

One great advantage of this work is that it dispenses with the use of costly apparatus and chemicals, thus enabling a student in the country to use it intelligently and readily. There are nearly one hundred illustrations, which, with the clear and precise style of the author's directions for working, will make the book just what the student needs.

SUMMER AND ITS DISEASES. By James C. Wilson, M. D. 160 pages, 12mo. Lindsay & Blakiston, Philadelphia. Cloth, 50 cents.

This is Vol. III of the American Health Primers issued by the above named well known medical book publishers, and though received rather late it will be found to contain many valuable things for the guidance of readers in the late summer and fall months. Its author, Prof. Wilson, is Physician to the Philadelphia Hospital, and as such has had a wide experience in every department of medicine. His manner of handling the various topics under consideration is clear and popular and his directions common-sense and practical.

Sunstroke and Heat Fever; Summer Diarrhea and Dysentery; Cholera Infantum; Summer and Autumnal fevers; Summer Colds and Hay Asthma; the Skin in Summer and its Diseases are the titles of the chapters which if carefully examined will be found to contain the information most needed for "the heated term."

THE CRUISE OF THE FLORENCE. Edited by Capt. H. W. Howgate, U. S. A. 183 pages. 12mo. James J. Chapman, Washington, D. C., 1879.

A very pleasantly written narrative, made up from the Journal of Capt. Geo. E. Tyson, who commanded the preliminary *Arctic Expedition* of 1877 and 1878. Without more than touching upon the scientific work of Professors Sherman and Kumlein this narrative gives a graphic account of the labors and hardships of the members of the expedition, the novelties and discoveries made and experienced

and the value of the regions visited to the trade and commerce of the world when developed. Once commenced, no reader will lay the book down before having finished it in full.

OTHER PUBLICATIONS RECEIVED.

Contributions to the Natural History of Arctic America by Ludwig Kumlien naturalist of the Howgate Polar Expedition of 1877-8. Daily Programme of the 28th Meeting of the American Association for the Advancement of Science, at Saratoga Springs, N. Y. Ninth annual Report of the Trustees of the Waterworks of Columbus, Ohio, for year ending March 31, 1879. Bulletin of the U. S. Geological and Geographical Discovery, Vol. V, No. 1 Radiant Matter, a lecture delivered by Prof. Wm. Crookes, F. R. S., Aug. 22, 1879, before the British Association for the Advancement of Science. Wonders of Light and Color, by Edwin D. Babbitt, New York.

EDITORIAL NOTES.

DR. EDWIN BABBITT, of New York, sends us a pamphlet entitled, "The Wonders of Light and Color," including a treatise upon Chromopathy, or the new science of color healing, with reports of numerous cases of different diseases cured by him and others by the use of variously colored medicines and substances. The principles enunciated are in accordance with recognized science and the experiments are worthy of repetition by those suffering similarly. Price 25 cents.

OUR former friend, *Sunday Afternoon*, comes out in a new medieval kind of cover, and with the new title *Good Company*, but from an inspection of its contents we do not find the company any more or less agreeable than before, thus verifying the statement that "a rose by any other name," etc.

THE *New York Medical Journal* for September, contains, among many valuable articles one on the Advantages of Cold Climates in the treatment of Pulmonary Consumption by Dr. Talbot Jones, who, forcibly sets forth the value of Minnesota as a health resort.

WE are again indebted to Prof. William Crookes, F. R. S., London, England, for a marked favor, in the shape of an advance copy of his able and most interesting address before the British Association for the Advancement of Science, delivered at Sheffield, August 22, 1879, upon Radiant Matter, a subject to which he has devoted more time and study and achieved more brilliant results than any other living scientist.

AT the next regular meeting of the Kansas City Academy of Science, the programme for the winter will be arranged. It is probable that a course of popular science lectures by some of the most distinguished professors in the west, interspersed with papers by resident members of the Academy, will be determined upon and provided for. Such courses have proved very entertaining and successful in other cities and doubtless will be as highly appreciated here.

WE were much gratified last week by a visit from the veteran geologist of Kansas, Prof. B. F. Mudge, who was on his way to Lawrence to deliver his semi-annual course of lectures upon Palæontology before the students of the Kansas University.

WE are indebted to Professors Putnam, Kedzie, Ingersoll, Bolton, Lovewell and others, for programmes, items and personal reports with regard to the proceedings of the American Association for the Advancement of Science, at Saratoga, last month. The newspapers of Saratoga contained only meager reports, very far inferior to those of the St. Louis dailies last year.

As will be seen by reference to page 353 of this number of the REVIEW, Prof. John H. Tice predicts the occurrence of an unusually copious shower of meteors on November 13th, and calls upon all observers to note whether or not his predictions are verified.

THE U. S. Entomological Commission, of which Prof. A. S. Packard, Jr., is Secretary, has issued a circular of inquiry into the existence and habits of the Hessian Fly in the west, and desires especially to ascertain the extreme western limits of its operations in Kansas, Nebraska, Minnesota and Dakota. Any of our readers having information on this subject will be of service to the country by communicating to Prof. Packard at Providence, R. I, any facts observed by these relative to the date of the appearance of the fly in Spring and Autumn, the date of its assuming the "flax-seed state," the number of broods annually, which varieties of wheat are least attacked by it and what other cereals and grasses are infested by it; statistics as to abundance and losses in their county, best preventives, etc., are very desirable.

PROF. J. D. DANA, of Yale College, writes as follows relative to Prof. Mudge's recent article on "Birds not derived from Dinosaurs":

NEW HAVEN, CONN., Aug. 31, 1879.

Dear Sir:—I have received the August number of your REVIEW, and think that Prof. Mudge is right in saying that the demonstration that birds came from Dinosaurs is far from complete, that there are more wide differences than close resemblances. To a *believer* in evolution, the demonstration is satisfactory, and, he says, complete, because with him it is only a question as to the line of descent; but one who questions the descent, may rightly demand far better evidence before admitting the conclusion. The weak point in the evidence *against* evolution, from the wide gaps, consists in the fact that almost nothing is known of the terrestial vertebrate life of the Mesozoic, especially the birds and mammals. Yours truly,

J. D. DANA.

A WORK of great value for reference to all book-buyers, book-sellers and book-makers, has just been issued by HOWARD CHALLEN, of Philadelphia, comprising all new books published by upward of four hundred publishers, arranged alphabetically, by subject, so that any new book on any topic can be ascertained, any new book by any author, and also by the title, with the price and publisher. The present issue embraces books issued from November 1878 to June 1879.

A supplement is in preparation of all books to November, 1879, with an Alphabetical Dictionary of all American and English Journals, arranged under subject or specialty, so that any Periodical, as well as any new book in any department of literature, can at once be ascertained.

PROFESSOR ERNEST INGERSOLL has been engaged for the U. S. Fish Commission and the U. S. Census Commissioner in a study of the natural history and economic value of the oyster.

PROFESSOR WILLIAM H. WAHL, of Philadelphia, associate editor of the *Engineering and Mining News* published in New York City, writes August 5th as follows: "* * * I take much pleasure in reading your REVIEW, and trust that you are succeeding with it."

THE article entitled "To the Young Men of Missouri," recently published in the Kansas City *Times*, was written by Dr. Wm. Fort, of Randolph county, Missouri, and contained many points of interest to the class to whom it was addressed. Dr. Fort is now 86 years old and was for over thirty years, prominent in State affairs.

IT is gratifying to observe our Missouri teachers are receiving due recognition and appreciation in other States. The latest case of this kind that has come to our notice is that of Prof. T. Berry Smith, who was last year in Pritchett Institute, Glasgow, Mo., and who has recenily been elected Professor of Chemistry and Physics in Carleton College, at Northfield, Minnesota.

MR. HENRY CABOT LODGE, one of the new editors of the *International Review*, contributes to the September number a review of the life of Secretary of the Treasury, Albert Gallatin—a life which marks as important an era in the financial history of the United States as that through which the nation is now passing. Mr. Philip Gilbert Hamerton begins his article on Rubens in the same number.

The Sanitarian for September, as usual, abounds with seasonable articles: the first is "The Education of Girls, as Connected with their Growth and Physical Development," by Nathan Allen, M. D., LL.D., which should not only be read by all educators, but by all parents who would appreciate the importance of physical and mental culture, and their just relations to each other in both the school and the family. Dr. Allen is well known to be among the foremost in social science studies generally, but in relation to the subject which heads this contribution he stands pre-eminent; and he has brought to bear upon it an amount of learning and practical knowledge of the utmost importance to the rising generation, which no educator who takes pride in his profession can afford to do without. Liernur's New System for Keeping Cities Clean, elucidated by diagrams and drawings, translated and commented upon by Dr. Laung, of New Orleans, should be read not only but studied by all sanitary engineers and others interested in the subject of sewerage disposal. Dr. Laung especially commends this system for New Orleans, but it is equally adaptable and no less necessary to other American cities; above all, to several of our Southern and Western cities, which, as yet, have adopted no plan consistent with health, and where the authorities have the advantage of investigating this means in the light of the numerous failures and dangers of other systems. True economy consists in the adoption of the best means for the protection of the public health. Those who would pursue this policy should study well this presentation of the admirable method of Capt. Liernur.

The Atlantic, for November, will open with the article postponed from the October number, on our Army and Military Organization, which will be of great value and interest. The closing chapters of Irene the Missionary will be given, and there will be two short stories, one by the author of Massy Sprague's Daughter. The number will be particularly rich in matters of literary interest, while on the side of politics and social discussion it will be fully sustained.

A PERUSAL of the *Contributions to the Natural History of Arctic America*, by Ludwig Kumlien, naturalist to the Howgate Polar Expedition of 1877-8, shows that the animal life of those regions is very abundant, and that unfavorable as were the conditions on the Florence during her cruise and winter stay, Prof. Kumlien labored diligently in searching for specimens of characteristic animals, plants and minerals and was exceedingly successful.

THE contents of *Harper's Monthly* for October are as follows: On the Skirts of the Alps.—Col. Geo. E. Waring, Jr., with ten illustrations; Painted Glass in Household Decoration.—Charles A. Cole, with nine illustrations; The Connemara Hills.—Miss J. L. Cloud, with seven illustrations; Fifty Years of American Art, III.—S. G. W. Benjamin, with sixteen illustrations; A Ramble in Central Park.—Helen S Conant, with thirteen illustrations; The Two Burdens, (a poem).—Philip Bourke Marston, with two illustrations; Through Texas.—Frank H. Taylor, with seventeen illustrations; White Wings: (a yachting romance).—William Black, with two illustrations; The State of the Alchohol Question.—Dr. Titus M. Coan; Belle's Diary, (a story).—Mary N. Prescott; Young Mrs. Jardine, (a novel).—D. M. Craik, with three illustrations; The Revolution in the Life of Mr. Balingall.—Sherwood Bonner; Mary Anerley, (a novel).—R. D. Blackmore; Editor's Easy Chair; Editor's Literary Record; Editor's Historical Record; Editor's Drawers.